AUG 7 1912

JOURNAL OF ELECTRICITY

POWER AND GAS

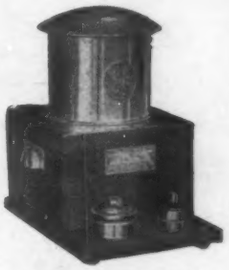
Devoted to the Conversion, Transmission and Distribution of Energy

Entered as second class matter May 7, 1906, at the Post Office at San Francisco, Cal., under the act of Congress March 3, 1879.

VOL. XXIX NO. 5 | SAN FRANCISCO, AUGUST 3, 1912 | PER COPY, 25 CENTS

General Electric Ozonators

DWELLINGS
HALLS
LODGE ROOMS



HOUSEHOLD TYPE
Can be attached to Electric Light Socket

THEATRES
CAFES
FACTORIES

OZONE improves ventilation by destroying the foul and harmful organic substances that are ever present where people congregate.

MANUFACTURED FOR USE ON ALTERNATING AND DIRECT CURRENT

Write for full information

Pacific States Electric Co.

SAN FRANCISCO
OAKLAND
PORTLAND
LOS ANGELES

Where to Buy It in the West, Pages 9, 10, 12 Alphabetical Index to Advertisers, Page 8.

FASTEST AND BEST
'TWIXT EAST AND WEST

The Only San Francisco and Chicago Limited Train

San Francisco

"Overland Limited"

Sixty-Eight Hours to Chicago
Electric-Lighted Throughout
Parlor Observation, Sleeping and
Unsurpassed Dining-Car Service
Attentive and Courteous Employes

The Route to Lake Tahoe and Yellowstone Park!

SEE OUR AGENTS

Southern Pacific Company

Flood Building Palace Hotel Market Street Ferry Depot

B 273285

JOURNAL OF ELECTRICITY
POWER AND GAS
Devoted to the Conversion, Transmission and Distribution of Energy

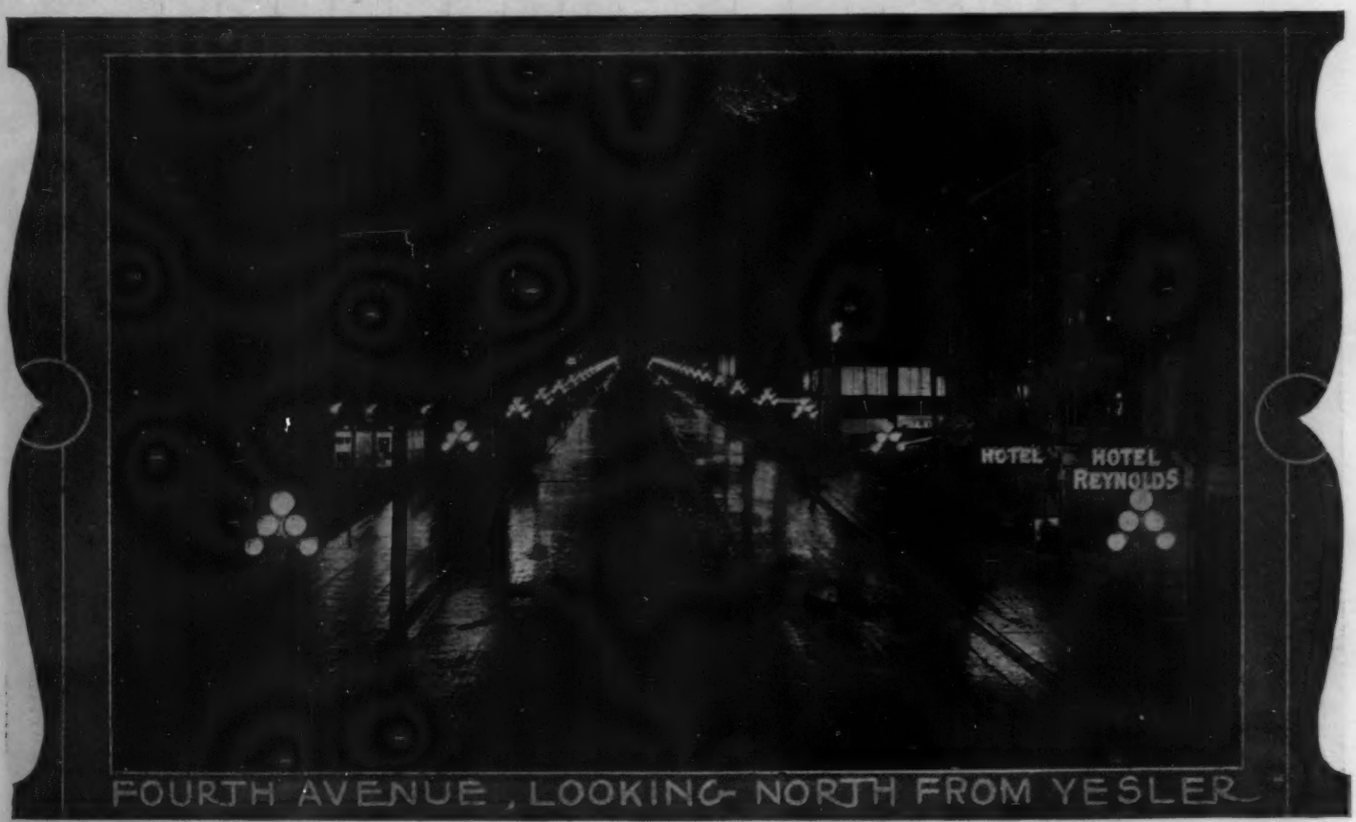
VOLUME XXIX SAN FRANCISCO, AUGUST 3, 1912 NUMBER 5

[COPYRIGHT 1912 BY TECHNICAL PUBLISHING COMPANY]

POWER DISTRIBUTION FOR SEATTLE MUNICIPAL PLANT

BY J. D. ROSS.

The Cedar River plant connects with the substation 38.7 miles distant in Seattle at Seventh avenue and Yesler Way by means of two transmission lines. The first of these lines built in 1904 consists of No. 2 solid B. &. S. gauge medium hard copper wire on Pittsburg insulators 14 in. in diameter. The poles are from 55 ft. to 85 ft. in length and with not less than 11 in. top. They are placed from 450 to 800 ft. apart except on curves and within the city. Corners are turned on two poles. All ravines and gulleys are spanned and the line is entirely dry and not influenced by floods.

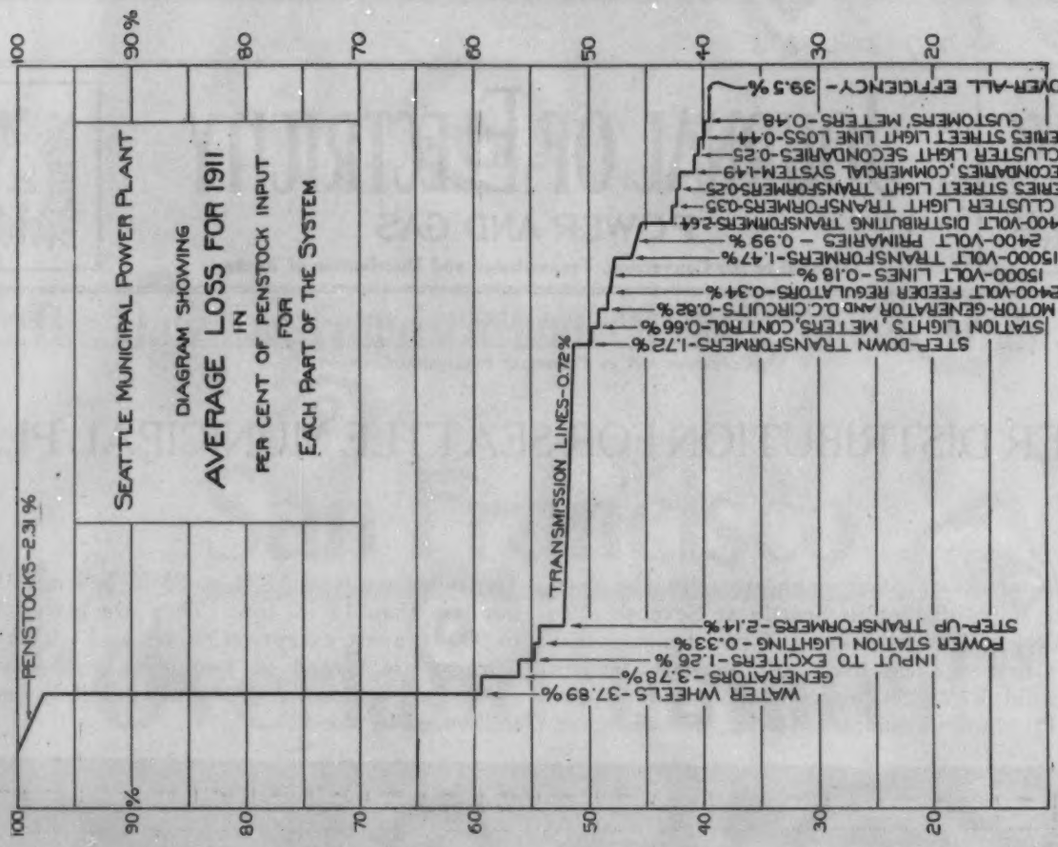


FOURTH AVENUE, LOOKING NORTH FROM YESLER

The wires are placed 6 ft. apart. The poles are of cedar 40 ft. in length, with 9 in. tops and placed 140 ft. apart. This line also carries a No. 11 copper telephone line.

The second line built in 1908 consists of No. 0000 seven-strand hard drawn copper cable placed in 7 ft. triangle on No. 3037 Thomas triple petticoat insulators. The cross arms are 8 ft. 4 in. by 6 x 8 in.

The spans are computed for a factor of safety of four and were sighted in, with corrections for temperature. This line is the only one of its kind in the country and has proven perfectly satisfactory, no failure having developed to date in spite of the high winds that it has passed through. This pole line carries a telephone line 15 ft. below the power arm consisting of seven strand 3/16 in. plough steel cable. This line is


SEATTLE MUNICIPAL POWER PLANT
DIAGRAM SHOWING
AVERAGE LOSS FOR 1911
IN
PER CENT OF PENSTOCK INPUT
FOR
EACH PART OF THE SYSTEM
PENSTOCKS-2.31 %
WATER WHEELS-37.89 %
GENERATORS-3.78 %
INPUT TO EXCITERS-1.26 %
POWER STATION LIGHTING-0.33 %
STEP-UP TRANSFORMERS-2.14 %
TRANSMISSION LINES-0.72 %
STEP-DOWN TRANSFORMERS-1.72 %
STATION LIGHTS, METERS, CONTROL-0.66 %
MOTOR-GENERATOR AND D.C. CIRCUITS-0.82 %
2400-VOLT FEEDER REGULATORS-0.34 %
15000-VOLT LINES-0.18 %
15000-VOLT TRANSFORMERS-1.47 %
2400-VOLT PRIMARIES - 0.99 %
2400-VOLT DISTRIBUTING TRANSFORMERS-2.64
CLUSTER LIGHT TRANSFORMERS-0.35
SERIES STREET LIGHT TRANSFORMERS-0.25
SECONDARIES, COMMERCIAL SYSTEM-1.49
CLUSTER LIGHT SECONDARIES-0.25
SERIES STREET LIGHT LINE LOSS-0.44
CUSTOMERS' METERS-0.48
OVER-ALL EFFICIENCY- 39.5 %
100
90 %
80
70
60
50
40
30
20

CITY LIGHT
SUBSTATION
7TH AVE & YESLER WAY
INTERIOR LAKE UNION
AUXILIARY PLANT
FOOT OF NELSON PLACE
SWITCH BOARD AT SUB STATION

transposed every 3100 ft. and the power line is transposed every 12,400 ft. Telephone transformers made in the city shops are used with grounded secondaries for all telephones. The two power lines are each cut into three sections with cross over air switches so that any defective section may be cut out. Millions of feet of heavy timber were cut, leaving nothing that can touch either line. At the substation end the lines are equipped with overload and reverse current time limit relays.

The lines are normally operated in multiple and measurements show that their combined efficiency at the average load of 1911 is 98.68 per cent.

The step down transformers are placed on the first floor of the substation. There are at present eight of these, each of 1500 kw. capacity at 35 degrees C. temperature rise. All are made with a ratio of 54,000 three-phase to 15,000 and 2500 Scott connected two-phase making four banks of transformers. The secondary coils are connected in series for 15,000 and in multiple for 2500 volts two banks being used for each voltage. Under careful test these transformers showed a maximum efficiency of 98.5. The all-day efficiency was found to be 96.60 per cent for 1911.

The distributing system was first designed for three-phase star connection but as there were two large companies in the city both operating two-phase the plans were changed to make it possible to interchange motors without special transformers.

Main Substation.

The city main substation at Seventh avenue and Yesler Way is a concrete and brick building of artistic design. The 60,000 and 15,000 volt switches and wiring are placed on the second floor. The transformers, motor generator set and switchboard on the first floor and the 2500 volt busses, switches and regulators in the basement. The switchboard designed and built in the shops of the department is 43 ft. 4 in. long, including the street lighting board, entirely of blue Vermont marble. The transformer panels are 20 in., the feeder panels 10 in., and the series arc panels 10 in. wide by 90 in. high, including 28 in. sub-base, by 2 in. thick, polished both faces and having ½-in. bevel. Alternating current and direct current instruments are horizontal edgewise type. The board is equipped with a complete set of curve tracing Westinghouse meters for recording frequency, power factor, voltage and wattage, on both high tension lines. Automatic feeder regulation is used throughout. At first, in 1907, G. E. type B. R. regulators were used but the G. E. induction type has been found more reliable and better and new circuits are being equipped with them.

All switches are electrically operated and the board contains no higher than 125 volts. All control devices are operated from a separate 25 kw. 125 volt current generator direct connected to an a.c. motor. A small storage battery has been added to serve emergency station lighting circuits and operate switches in any emergency.

Street circuits are supplied from 6.6 ampere 100-light G. E. air-cooled constant current transformers. Each of these is equipped on the primary side with a small oil switch electrically operated, made by the department, and a small test board with plug switches. This arrangement allows of the main switchboard being merely a 125-volt control board.

A motor generator set consisting of a 750 h.p. two-phase synchronous motor direct connected to two 250 kw. 250-volt direct current compound wound generators is used on a three-wire 500 and 250-volt system for operating elevators and other motors. The maximum load on this machine at the present time on the direct current side is 300 kw. and the average load for 1911 was 30.2 kw. The surplus kilovolt-ampere capacity of the motor is utilized in regulating the voltage of the main system by varying the power factor by means of a Tirrill regulator controlling the field of the motor. The all-day efficiency of the motor generator was during 1911, 38 per cent and the efficiency of the distributing direct current system is estimated to be 95 per cent. The direct current system was installed in order to accommodate the patrons of the plant who do their lighting from the a.c. mains and so enable the plant to better compete for large business loads.

There are at present 71 services connected on this system with a connected load of 772½ h.p. The main feeder is 750,000 c. m. cable with a 400,000 c. m. neutral, and the branches usually No. 4/0 with No. 2/0 neutral. In all, 27 miles of wire are used on this system.

15,000 Volt System.

A municipal plant must adhere to uniform rates at all distances from the station much more closely than a private concern, although the cost of current delivered in distant suburbs is greater; the question of cheap transmission to suburbs has therefore been carefully studied. The economic distance to which 2500 volts could be carried was computed from the cost of material and labor, interest on bonds, and net value of current per kw. annum, and beyond the economic distance substations were installed at 15,000 volts and distributing at 2500 volts giving better economy and regulation. One of these at Fremont, distant 19,200 ft. from the substation, has a capacity of 1500 kw. at 40 degrees C. temperature rise. Another at West Seattle, 26,000 ft. distant from the substation, has a capacity of 500 kw. at the same rating. A similar substation has been completed at Hillman and a site purchased for one in Ballard. For mechanical reasons No. 2 is the smallest wire used for 15,000 volt transmission. These lines travel largely along the water front on Puget Sound where there are a number of large power users and along Lake Union where the new canal will bring a considerable number of industries. In all, these lines traverse 10.7 miles of waterfront and will eventually follow the entire water front of both salt and fresh water.

It is obvious that some system would be ideal that would supply all large industries from the 15,000 volt lines direct, leaving only the lighting of the suburbs beyond to be handled by the substations, thereby requiring much smaller transformers and giving vastly better regulation. It was also desired to use pole type transformers except for very large loads. A three-phase star system was the nearest approach to the ideal then in use and a system was therefore designed for the purpose, using a two-phase 15,000 volt system, the center point of each transformer being brought out and connected to a fifth wire which was

grounded frequently along the line. This system gives in reality four circuits for the two phases. Power is transmitted at 15,000 volts but is distributed along the line for large power and lighting loads at 7500 volts, stepping to the supply voltage desired. To this end 7500 volt transformers are placed on poles in the usual way and connected from the outside wire of a phase to the neutral wire as in the ordinary three-wire system. Submarine cables have 15,000 volts between wires but only 7500 volts to lead sheath. This system has given entire satisfaction and makes substation work easier by eliminating large power loads from the automatic regulators.

2500 Volt Distributing System.

Power is distributed from the substations by means of seventeen 2500 volt primary feeders. Of these, twelve are fed from the main substation at Seventh avenue and Yesler Way, three from Fremont substation and two from West Seattle substation. The heavier loaded circuits were designed for 200 amperes, and the lighter ones for 150 amperes. Number 4/0 wire was used at first, but the economic size for a 200 ampere feeder has been computed at 350,000 c. m., which size is now used on the heavier feeders.

An area of 28 square miles is served by this system extending seven miles south and six miles north of Yesler Way. A distributing point is established at the approximate center of distribution for each feeder, and the automatic regulators in the station are set to give the desired voltage at this point. This voltage is regularly checked by placing a recording volt-meter at the distributing point, and any variation from normal is noted and corrected.

Connected to the 2500 volt feeders are 1082 distributing transformers, ranging in size from 2½ kw. to 50 kw., and with an aggregate full-load capacity of 9268½ kw. They are connected to give a 250-125 volt three-wire secondary, with the neutral grounded. To aid regulation, a number of transformers of the same size and type are usually connected together on the secondary side where conditions will permit. Since the department is extending its lines to every suburb, there are many scattered communities in the outlying districts where one or two transformers are sufficient to carry the load. It is this condition that makes the problem of regulation difficult, and requires heavy copper and careful attention to the station feeder regulators. The secondary wire is generally No. 4 for the outside wires and No. 6 for the neutral, with No. 8 for the services. The maximum voltage drop from transformer to customer is kept within 2 volts whenever possible, since there is no way of regulating for voltage between these points. The pressure at the service is kept as near 120 volts as possible. Although standard 2200-110 volt transformers are used, the pressure has been raised to 2500 volts. This gives about 25 per cent higher core loss, but lowers the copper loss in both transformers and feeders about 29 per cent, and in addition gives nearly 14 per cent better regulation. The 2500 volt system requires 545.4 miles of primary wire ranging in size from No. 6 to 350,000 c. m. and 1,137.1 miles of secondary wire, varying from No. 6 to No. 4/0. To carry this wire 17,602 poles are required.

The all-day efficiency of the 2500 volt distributing system for 1911 was 78.0 per cent. This is the ratio of the power sold to the output of the substations. The transformer losses were computed from careful tests made on each type and size of transformer under actual operating conditions. The line losses were computed from the load curves taken at distributing points and at the stations, and checked by recording voltmeter charts taken at the same points. The loss in customers' meters is computed on the basis of tests taken by the meter department.

By Ordinance No. 21655, effective September 12, 1909, all overhead wires in the district bounded by First avenue, Cedar street, Fifth avenue and Jackson street were ordered underground, and three years was set as the time for making the change.

The lighting department already owns 262,000 duct feet of vitrified clay conduit in the streets, exclusive of that used for cluster lights, and has arranged for the installing of approximately 500,000 duct feet of vitrified clay during 1912.

The underground feeders will carry 7500 volts and 2500 volts, feeding from 15,000 volt transformers having the center tap grounded. The secondaries will be a 250-125 volt three-wire system. All underground cable will be lead-covered, with varnished cloth insulation. The underground system, as well as all of the distributing system, is designed to care for the probable future demand with the least possible reconstruction.

Lake Union Auxiliary.

A 5000 kw. steam auxiliary in Seattle to supply power over a possible dry season and to give relief during accident to the water power plant is now under consideration and all plans completed. An attempt was made to find a suitable system of gas engine drive, but owing to the character of the oils and coals of the Pacific Coast, the attempt was abandoned until this line of apparatus is better developed in the large units.

The need for a plant capable of immediate action in emergency was met, however, by installing a hydro-electric plant using the excess water of the city water works. This plant is situated on the east shore of Lake Union and receives its water supply through a 40-inch riveted steel pipe 3400 feet long from Volunteer Park reservoir which is at 412 feet elevation above Lake Union. This plant has a capacity of 2000 h.p. and operates at 2500 volts two-phase connecting directly with the main substation at Seventh avenue and Yesler Way through heavy stranded aluminum cables. This plant is now installed and will immediately care for a considerable load during emergency.

It is intended that the steam plant will be situated on the same site which will be accessable for its fuel supply from the Northern Pacific Railway or by the new Lake Washington canal. It is intended to install duplicate steam turbines. The water of the boilers will be kept hot from an electric heating coil during off peak hours so that quick action may be had in emergency.

Series Street Lighting System.

The series street lighting system comprises 683 miles of No. 6 wire divided into 29 circuits, lighting 601 miles of streets. The circuits are connected two in series to 6.6 amperes 100 light air cooled General Electric constant-current transformers. Each of these

is equipped on the primary side with a small solenoid-operated oil switch made by the department, and with a test board with plug switches. This arrangement keeps all pressures above 125 volts away from the switch-board. The voltage on the circuits varies with the number and kind of lamps from 2500 volts to 5000 volts. In all there are 692 6.6 ampere arc lamps, 5315 40 c.p. tungsten lamps, and 199 300 c.p. tungsten lamps. The large tungsten lamps were manufactured especially for the department. They have proved satisfactory in every respect, giving steadier, better distributed light and averaging over 2000 hours of life. The 40 c.p. tungstens are mounted by "goose-necks" on the line poles. This type of lamp is ideal for its purpose since it gives light in small units at a minimum cost of maintenance and power.

The test of the series lighting circuits shows an all-day efficiency for 1911 of 86.3 per cent from the switchboard to the lamp. The loss in the transformers was 5.0 per cent, and in the line, 8.7 per cent.

Cluster Lights.

Seattle's cluster lighting system is one of the finest in existence and is generally admired by tourists and visitors from all parts of the country. The main business avenues are lighted by five-lamp poles, placed opposite each other at the curb line and spaced at eighty and ninety feet. The usual design of a five-lamp pole places four globes in the form of a cross, with one center top globe. The Seattle poles, however, have the lamps placed in a triangle perpendicular to the sidewalk, with a 16-in. globe at the top, two 14-in. below, and two 12-in. globes, turned downward, at the base of the triangle. All the globes have a light sand-blast finish. This design gives a beautiful effect of festoons of decorative lights along the sidewalks, and at the same time secures a uniform illumination on all parts of the street. The intensity on the sidewalk varies from 0.32 to 0.79 foot-candles, and at the center of the street from 0.34 to 0.45 foot-candles. This illumination, which is ample, is produced by using 50-watt tungsten lamps fed from a small transformer in the pole base at a pressure of 8 volts. This type of lamp was designed by the General Electric Company especially for the lighting department, and has proved so satisfactory that it has since been made standard by that company. The average life of this lamp has proved to be over 2000 hours.

In residence districts, where lower illumination is sufficient, three-globe poles are used, similar to the five-globe poles with the two lower globes omitted, In the parks and along the driveways a single 20-in. globe with a 75 watt 12½ volt lamp is used. Altogether there are 1116 five-ball poles lighting 13.5 miles of street, 378 three-ball poles lighting 8.5 miles, and 137 one-ball poles lighting 3 miles of street, making a total of 1631 poles lighting 25 miles of street.

In the business district the system is fed from underground mains placed near the curb line. The main feeders are placed in vitrified clay duct with the commercial feeders, and the branches are run in fibre conduit cased with concrete. An exception to this is made when the ducts run under the walk where a basement is to be excavated. In these places steel conduit is used, placed just beneath the sidewalk. Manholes for transformers are placed below the sidewalk at street corners, about three blocks apart. Five, ten and fifteen kilowatt transformers are used, all on one street being alike. These transformers are connected to feed both ways from the manhole, the lamps in each section of street being fed from one secondary coil of each adjacent transformer. A three-wire lead-covered secondary cable is used, so connected that the blowing of a fuse will leave each alternate pole dark, and so leave the street still fairly well lighted. The secondary voltage is 120-240 stepped down to 8 volts by the pole base transformers.

The cluster lights in the business section are controlled from the substation. The cluster light poles were designed by the department, and made in Seattle. The idea of using low voltage lamps and transformers originated with the Seattle lighting system, the first low voltage transformers used in street poles being designed and built in the city light shops while the first low voltage tungsten lamps used for them were made by the General Electric Company by request of the department. This system gave over 2000 hours life to the lamps and the system has been rapidly adopted all over America.

INCREASING BOILER CAPACITIES.

The United States Bureau of Mines makes the statement in Bulletin 18 on the Transmission of Heat Into Steam Boilers, just issued, that the present steaming capacities of steam boilers can be tripled or quadrupled by forcing over the heating surfaces three or four times the weight of gases now passed over them. With well-designed mechanical-draft apparatus this greater weight of gases can be forced through the boilers at small operating cost.

The principles governing the combustion of fuel in boiler furnaces and the absorption of heat by boilers have been little understood. The dogmas that the area of grate should have a certain ratio to the area of the heating surface, and that it takes 10 square feet of heating surface to make one boiler horsepower, seemingly had become so thoroughly fixed in the mind that they were hardly ever questioned. It is only within the last decade that a few engineers have broken away from the old rule of thumb methods and have begun to investigate the functions of the boiler and furnace separately. Their studies seem to mark the beginning of advance in steam-generating apparatus.

The boiler is the metallic vessel that contains water and steam and absorbs heat; consequently it should be studied as a heat absorber.

The furnace is that part of the steam-generating apparatus in which the potential energy of the coal is changed into heat; consequently it should be studied as a heat generator.

GATUN DAM SPILLWAY, PANAMA.

The concrete work in the Spillway of Gatun Dam is over 89 per cent completed, 201,748 cubic yards, out of a total of 225,000, having been placed at the close of work on June 22.

ELEMENTS OF HYDRAULIC ENGINEERING

CALCULATION OF SPECIFIC SPEED.

BY GEO. J. HENRY JR.[1]

In the preceding article of this series[2], some general formulae were developed to establish a clear understanding of what takes places in the action of a water wheel. To pursue the reasoning a little further it will be seen that if the pitch circle of a tangential wheel runs at from 42 to 47 per cent of the spouting velocity corresponding to the effective head at the gate or nozzle inlet its velocity will be $\frac{42 \text{ to } 47}{100}\sqrt{2gh}$. If we take 45 per cent of the spouting velocity as a mean value we would have

$$\frac{\pi D_p n}{60 \times 12} = \frac{45}{100}\sqrt{2gh} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (17)$$

where D_p = pitch diameter in inches and n = revolutions per minute.

Transposing,

$$n = \frac{7.2 \times 45 \times 8.025\sqrt{h}}{\pi D_p} = \frac{827.2\sqrt{h}}{D_p} \times \text{Constant} \ldots (18)$$

$$\text{and } D_p = \frac{827.2\sqrt{h}}{n} \times \text{Constant} \ldots (19)$$

Table IV enables us to at once determine the revolutions per minute or the pitch diameter for any runner for a given peripheral velocity because from (18) and (19)

$$n D_p = \text{Constant } \sqrt{h} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (20)$$

If therefore we select the proper constant from this table and multiply it by the square root of the head and divide the result by the pitch diameter in inches, we will have the revolutions per minute the wheel should run, or if we divide the result by revolutions per minute we will have the pitch diameter in inches of the wheel.

In order to use the table most effectively, we must make an intelligent selection of the constant, and to do this, some further consideration is necessary.

It is seen above (20) that the speed (revolutions) varies as $\sqrt{h}$ and therefore we can say that for any given wheel which runs at n revolutions per minute under h head, the number of revolutions it should run under one foot head would be

$$n_1 = \frac{n}{\sqrt{h}} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (21)$$

Example 5: What will be the pitch diameter of a wheel whose pitch circle runs at 45 per cent of the spouting velocity under 490 ft. head if we wish it to deliver its best efficiency at 560 r.p.m.?

[1]Consulting Hydraulic Engineer, Rialto Bldg., San Francisco.

[2]May 25, 1912, and June 1, 1912, for correction of errata.

then n = 560 and h = 490, hence

$$D_p = \frac{827.2\sqrt{490}}{560} = 32.7 \text{ in.}$$

Example 6: At what speed should the wheel in Example 5 run if the head be reduced from 490 ft. to 1 ft.?

$$n_1 = \frac{560}{\sqrt{490}} = \frac{560}{22.13} = 25.3 \text{ revolutions per}$$

minute, and as shown in (4) the power output

$$\text{h.p.} = \frac{Q \times 62.4 \times h}{550} \text{ can be expressed as equal to a}$$

constant times a v h. In other words the energy E is a function of the velocity v times the head h., or as v is a function of $\sqrt{h}$ we may write

$$E = f h \sqrt{h} = f h^{3/2} \quad \ldots\ldots\ldots\ldots\ldots\ldots (22)$$

It is therefore clear that if a certain horsepower P is developed by a given wheel under a given head then under 1 ft. head the same wheel and nozzle will develop $\text{H.P.}_1 = \frac{\text{H.P.}}{h^{3/2}}$ ..... (23)

Example 7: If the wheel in Example 5 with a 2 in. circular diameter jet, as in Example 3, should give 172 h.p. under the head of 490 ft., what h.p. should it give under 1 ft.?

$$\text{H.P}_1 = \frac{172}{490\sqrt{490}} = \frac{172}{10844} = .01576$$

For the purpose of comparing different wheels with one another, and for determining what any wheel under one head may be expected to accomplish under another head it is customary to reduce them to unit conditions and express this constant for the runner as that speed at which it should run under 1 ft. head when developing 1 h.p. and this is generally termed the specific speed.

By (21) we find the speed of any runner under 1 ft. head and by (23) the horsepower under 1 ft. head.

If we have a wheel of diameter D_p running at n_1 revolutions under 1 ft. head and if the jet impinging on the buckets is of area a, it is obvious that if we vary all the linear dimensions of the wheel so as to keep the same design proportions that the area a will vary as D^2 or D varies as $\sqrt{a}$. But as the area of the jet is proportional to the h.p. and D is proportional to the revolutions we may write

$$D \text{ and } n \text{ vary as } \sqrt{\text{H.P.}} \quad \ldots\ldots\ldots\ldots\ldots\ldots (24)$$

Therefore we may write the specific speed (S) at which any given wheel will run under 1 ft. head when of such proportions that it will develop 1 h.p. and

% of Spouting Velocity.....	42	43	44	45	46	47	55	60	62	63	64	65	66	67	68	70	72	74	77	80
Constant for use in formulae.	770	790	808	827	845	863	1010	1103	1140	1158	1176	1195	1213	1231	1250	1286	1323	1360	1415	1470
	Tangential Wheels.																Francis Turbines.			

$N \times D_p = \text{Const.} \sqrt{h}$.

Table IV—For determining revolutions where pitch diameters are known or for determining pitch diameters where revolutions per minute are known.

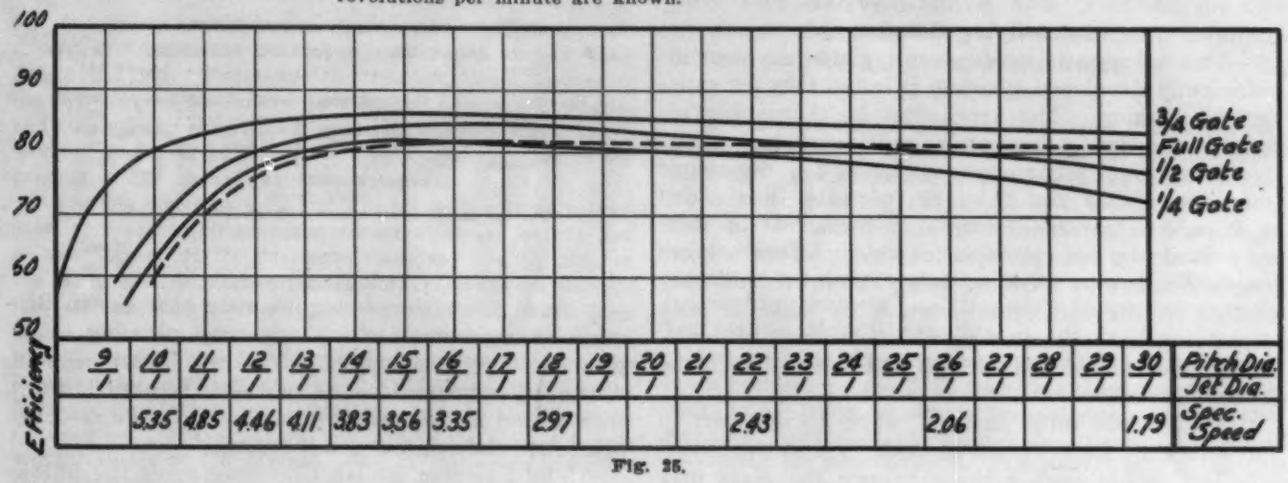


Fig. 25.

which was originally designed for n revolutions under h ft. head as:

$$S = \frac{n}{\sqrt{h}} \times \sqrt{\frac{h.\,p.}{h\sqrt{h}}} = \frac{n\sqrt{h.\,p.}}{h\sqrt[4]{h}} = \frac{n\sqrt{h.\,p.}}{h^{5/4}} \quad \text{---------- (25)}$$

and in metric units $S_m = 4.42\ S$.

Example 8: What will be the specific speed of the wheel in Examples 6 and 7?

$n\sqrt{h.p.} = 25.3\sqrt{.01576} = 3.17 = S$, and in metric units $= Sm = 3.17 \times 4.42 = 14$.

A careful review of all the reliable data I have been able to collect indicates that the best efficiencies

PD/d	10/1	11/1	12/1	13/1	14/1	15/1	16/1	18/1	22/1	26/1	30/1
Spec Speed	5.35	4.85	4.46	4.11	3.83	3.56	3.35	2.97	2.43	2.06	1.79
	Efficiencies										
Full Gate	60	70	76	79	80	81	82	82	82	81	81
3/4	80	83	84	85	86	87	86	86	85	84	83
1/2	68	75	80	82	84	84	84	84	82	80	77
1/4	62	72	77	80	82	82	82	81	80	77	73

Table V.

for tangential wheels are obtained with pitch diameters from 10 to 30 times the jet diameter. Efficiencies that should be obtained and the corresponding specific speeds are given in the accompanying table V and the efficiencies are further plotted in Fig. 25.

PREVENTION OF ELECTRICAL MINE ACCIDENTS.

The problem of safeguarding electrical mine equipment is discussed by H. H. Clark in Technical Paper No. 19 from the Bureau of Mines. There is no general formula or equation for its solution. Moreover, there are so many variables involved, so many factors that cannot be exactly related, so many possible coincidences, that results cannot be predicted with mathematical exactness. It is necessary to consider each part of the problem by itself, in the light of local conditions, and to adopt such measures as insure a large factor of safety.

Scanty light, limited space, and the presence of dust and dampness are underground conditions that are favorable to the occurrence of electrical accidents. The influence of the first of these may be eliminated by providing lights at particularly dangerous places, such as partings and crossovers. If electric wires are a source of danger at such places, they can be made a source of light also.

Although it may be impracticable to eliminate entirely the effect of limited space, this condition may be counteracted by the erection of guards about apparatus.

Dust and dampness are elements that can hardly be separated from the operation of a mine; in fact, the presence of dampness is often desirable to offset the effect of dust. It is possible, however, to provide apparatus so designed and installed as to resist the action of dust and dampness, and the more generous the factor of safety included in such design and installation the greater will be the resistance.

The problem of safeguarding may be divested of some of its vagueness and put in concrete form by considering that if the electric current can be kept where it belongs—in the conductors designed to carry it—it cannot give shocks, set fires, or ignite gas, dust, or explosives. Electricity becomes actively dangerous only when it breaks away from its proper channels in stray currents or as sparks and arcs.

It must be admitted that the electric current cannot be kept where it belongs in the sense of eliminating entirely such sparks and arcs as occur at fuses, circuit breakers, air-break switches, starting rheostats, and the commutators of direct-current machines. In this connection the factor of safety must be applied by arranging to confine the outbursts of current to a limited area unoccupied by anything which may be affected by heat or fire.

Assuming that in the selection and installation of electric equipment care has been exercised to insure the proper confinement of the current, the factor of safety may be increased by grounding the dead metallic parts of apparatus, by providing means for insulating the bodies of those who work upon such apparatus, and by barring from the vicinity of the current such elements as are explosive or combustible.

PHOTOGRAPHY IN ENGINEERING

BY M. R. LOTT.

Intensifying Solution.

This solution is used when a plate has been insufficiently developed or when it is too thin for satisfactory printing. The hypo must be thoroughly removed otherwise yellow stains will result.

A solution prepared as follows: 1¼ ounces of potassium iodide and 6 ounces of water has added to it, a concentrated solution of bichloride of mercury until the red precipitate which forms will no longer dissolve by shaking, being careful to add only enough of the bichloride solution to make it only slightly turbid. To this is added 1 ounce of hypo, which is dissolved and enough water added to make 20 oz. of solution.

To use add three parts of water to one part of the solution. Care should be taken not to overintensify but should such a thing happen the plate may again be reduced by placing it in the hypo bath for a short time.

Reducing Solution.

This solution is used in case the negative is too dense to print well, and is prepared as follows:

Dissolve 1 part Red Prussiate of Potash in 15 parts of water and place the solution in a bottle wrapped with yellow paper to guard against decomposition by light.

To a solution of 1 oz. hypo in 15 oz. water, add ½ to 1 oz. of the Red Prussiate solution immediately before use.

A negative may be reduced immediately after fixing, a plate already dried should be soaked in water a short time before being treated.

Reduction should take place in subdued light.

The above solution may also be used for reducing over-developed Velox prints though potassium cyanide usually gives better results. When potassium cyanide is used it may be either as a solution or a cake of it may be rubbed directly on the print itself. As potassium cyanide is extremely poisonous care must be observed in its use.

Eastman's M. Q. Developer.

This developer is designed especially for Velox prints and gives very good results. The stock solution should be placed in small bottles as it keeps better in small quantities. Should trouble be experienced in keeping the hydrochinon in solution the trouble may be eliminated by adding 13 ounces of wood alcohol to the stock solution mixed in the quantities given below. Wood alcohol must be used instead of the denatured as the latter does not accomplish the desired result.

Mix in the order named.
Dissolve in 100 ounces of hot water

Metol	½ oz.
Hydrochinon	2 oz.
Sulphite of Soda (dessicated)	7½ oz.
Carbonate of Soda (dessicated)	10½ oz.
Potassium Bromide	¼ oz.

To use dilute with water
1—4 for Special Velox
1—2 for Regular Velox
1—6 for Eastman's Bromide Paper

Non-abrasion may be secured by adding 10 grains of potassium iodide to each ounce of the stock solution. This also gives a yellow cast to a print the color disappearing when fixing is complete.

FIXING AND HARDENING SOLUTION.

Water	64 oz.
Hypo	16 oz.

To which is added the hardening solution prepared as follows:

Water	5 oz.
Sulphite of Soda (dessicated)	½ oz.
Acetic Acid No. 8 (containing 25% pure acid)	3 oz.
Powdered Alum	1 oz.

EASTMAN'S BROMIDE PAPER.
DEVELOPER.

Use the M. Q. Stock solution diluted 1—6.

FIXING SOLUTION.

Hypo	3 oz.
Water	16 oz.

FOR SEPIA TONES.

Sepia tones sometimes impart a richness to Bromide enlargements which are very pleasing. The print to be treated is first placed in a bleaching solution until only faint traces of the half-tones are left, then rinsed in clear water and placed in the re-developer until the original detail returns.

The Eastman Kodak Company gives the following formulas:

1. BLEACHING SOLUTION.

Ferricyanide of Potassium	5 oz.
Bromide of Potassium	6 oz.
Water	120 oz.

2. REDEVELOPING SOLUTION.

Sulphide (not sulphite) of Soda	5 oz.
Water	60 oz.

To use
Prepare Bleaching Bath as follows:

Solution 1	4 oz.
Water	4 oz.
Aqua Ammonia	4 drops

Prepare Redeveloper as follows:

Solution 2	1 oz.
Water	8 oz.

Properties of Chemicals.

The chemicals used in the preceeding formulas have the following properties:

Alum. A white substance used in fixing solutions for paper and negatives to harden the gelatine film.

Bichloride of Mercury. A white compound, highly poisonous, used in intensifying solutions to blacken a weak negative.

Bromide of Potassium. A whitish crystalline substance used in a developer as a restrainer to counteract the effects of over-exposure, restraining the development of the shadows thereby increasing contrast.

Carbonate of Potassium. A whitish compound used in a developer to give the alkalinity required for action.

Carbonate of Soda. A whitish powder used in developers as an alkali, its action being similar to that of potassium carbonate, six parts of carbonate of soda being equivalent to three parts of potassium carbonate.

Chrome Alum. A purplish powder used as a hardener in fixing solutions.

Cyanide of Potassium. A white poisonous compound used to remove stains and to bleach prints.

Ferricyanide of Potassium. A red crystalline substance, also known as Red Prussiate, used as a reducing agent for negatives and prints.

Hydrochinon. A yellowish white substance coming in the form of needle like crystals. Used as a developing agent.

Hypo. Thiosulphate of Sodium. A white crystalline substance used as a fixer for negatives and prints.

Metol. A grayish powder used as a developing agent.

Oxallic Acid. Whitish crystals, used as a preservative in Pyro developing solutions.

Pyrogallic Acid. A white substance used as a developing agent.

Sulphite of Soda. A white compound. Used as a preservative in alkaline developers. It must be kept tightly sealed from the decomposing action of the air.

THE ELECTRICAL CONTRACTORS' DEPARTMENT

CONTRACTORS' CONVENTION.

The third annual convention of the California State Electrical Contractors' Association was held at San Jose, July 24-27, 1912. Wednesday and Thursday were devoted to routine business discussions between the members, the ladies and guests being entertained by automobile trips. Thursday's meeting was held at Palo Alto with a theatre party in the evening.

Friday's meetings were open to all with a large attendance of representatives from central stations, jobbers and manufacturers. H. V. MacMeans described the workings of the compensation plan of the Roseberry employers liability law. Milton Wise read a paper on Advertising, W. S. Hanbridge spoke on Estimating, C. W. Mitchell on the Underwriter's Rules, T. E. Bibbins on the Relations between the Manufacturer and the Contractor, C. C. Hillis on the Relations Between the Jobber and Contractor, and A. H. Elliott on Co-operation. These papers will appear in this and subsequent issues of the Journal. Geo. C. Holberton described the system of the Pacific Gas & Electric Company, illustrating his talk with a large number of lantern slides.

The election of officers resulted in the re-election of John G. Rendler as president, J. S. Reynolds as vice-president, W. S. Hanbridge as secretary-treasurer, and Robert Booth as sergeant-at-arms. C. V. Schneider was also elected vice-president.

The various electrical inspectors present formed a state association which will be affiliated with the national organization.

The annual banquet on Friday evening was a most brilliant affair and greatly enjoyed by all present. Dancing concluded the evening's entertainment.

Saturday was devoted to the Electrical Trades' picnic, a crowd from San Francisco joining forces with the delegates. In the morning a baseball game was played between the northern and the southern contractors, the former winning by the score of 12 to 6. After an enjoyable picnic lunch there were a large number of amusing races for prizes and later a baseball game between the Jobbers and Contractors, the former winning by the score of 20 to 11, score cards being presented by the Stewart-Fuller Company.

SONS OF JOVE REJUVENATION.

A Rejuvenation of the Sons of Jove was the crowning event of the convention on Saturday evening. A class of 42 were initiated into the order under most favorable auspices by the San Francisco members. The degree team consisted of A. E. Drendell, Jupiter; E. B. Strong, Neptune; M. L. Scobie, Pluto; T. E. Bibbins, Vulcan; John R. Cole, Hercules; Arthur H. Halloran, Mars; G. I. Kinney, Apollo, Fred Poss, Avrenim, and W. W. Hanscom, Mercury, ably assisted by half a dozen imps.

The candidates were as follows:

Anderson, P. A.	Fisher, R. E.	Markham, Monroe
Arbogast, G. E.	Fuller, A. R.	McNally, W. A.
Battee, Geo. H.	Fulton, Alex.	Miller, H. L.
Belden, Geo. F., Jr.	Gallivan, D. G.	Newbert, Lee H.
Booth, R. L.	Hand, E. D.	Parsons, T. H.
Britton, J. A.	Hemington, W. A.	Phillips, M. W.
Bullard, A. W.	Hixson, M. C.	Skoog, Sidney P.
Burkhart, E. F.	Holberton, Geo. C.	St. John, T.
Butte, C. F.	Hook, R. W.	Tardif, W. J.
Capps, I. L.	Hope, N. M.	Thompson, A. V.
Cohn, Seth	Hyler, A. M.	Vander Naillen, R. L.
Davis, G. W.	Kohlwey, W. D.	Watts, Frank W.
Dougall, R. B.	Levy, Phil	Wise, Milton E.
Eppstein, Clarence	Liebes, A. J.	Yost, W. F.

This convention was the most successful yet held. Many vexing questions were amicably settled, new acquaintances were made and old ones renewed, and a most profitable session resulting to all concerned. There is a strong likelihood of the early formation of a Pacific Coast organization which will include the contractors of Washington, Oregon and California.

HOW THE MANUFACTURER AND CONTRACTOR CAN ASSIST EACH OTHER IN THE GENERAL UPBUILDING OF THE ELECTRICAL BUSINESS.

BY T. E. BIBBINS.

I was requested to talk on the subject "What the contractor should do to assist in developing the manufacturer's business." The subject as outlined does not meet with my views of co-operation, and therefore I took the liberty of making the suggestion to your committee, which was accepted, that the subject be made "How the manufacturer and contractor can assist each other in the general upbuilding of the electrical business." All this might be summed up in the very familiar term "Co-operation."

When we look back over the past, those who are older in the business will recall the time when the contractor hardly spoke to his fellow, because of jealousies and lack of understanding. Unquestionably this was also so, among the jobbers and among the manufacturers. Personally, I hold to the view that the better one knows his competitors, the easier his path, and in the end the business of the whole, as well as of one's company, is promoted. I have always felt that this was the line of procedure, from a commercial, as well as a personal standpoint, and it will apply to the contractor in his relations to his brother contractor, and also in his relations to the manufacturer. Right here let me say that your association is right in line with this idea.

The contractor has unquestionably a very important position in the electrical world. The manufacturer has found by experience, and costly at that, that he cannot manufacture and do contracting at the same time. He must abandon one or the other. I can well recall the time when one of the large manufacturers not only made its apparatus and supplies, but attempted to do wiring of buildings. Some of you will recall that they wired the old Chronicle Building, and the Mills Building in San Francisco. Station wiring and general construction which had to do with the electrical equipment was done by the manufacturer. The policy today of the manufacturer is to leave this to those who know how to do it economically and well. Unquestionably this is an age of specialists, and specialists can be contractors, and contractors should be specialists.

Where there is competition, naturally there will come misunderstandings and friction. Where the manufacturer comes into competition with the contractor, it can be expected that this same misunderstanding and friction will occur. Here is an opportunity to apply our subject. We have got to be broad-minded in our relations to each other, and recognize these competitive conditions that may come about, in a manful way. Obviously it is poor policy to lose our heads here, and in retaliation strike a fatal blow; but rather let us be patient with each other.

For the contractors to consider that they are body unto themselves is a mistake, for there are four parts or branches to the body—the electrical contractor, the electrical dealer, be he retailer or wholesaler, the seller of electric current, and the electrical manufacturer. No one of these four branches of the complete body can be attacked without harm being done to the other. With full knowledge of the fact, can you afford to attack another part of the body? When one part lacks prosperity, the others suffer in like extent. Therefore it is to your own interest to assist in the healthy upbuilding of the others, and believe me, in this you build for yourself. You should not make light of your ability to help here. The effect will be far-reaching if, at the right time, each one of you should say the right and kindly word of the power company, the jobber and the manufacturer, and in more material ways assist each along the way to prosperity. Let us forget

for all time how to knock—let us boosters be. Let us feel the dignity and largeness of our position, and live up to it.

It seems that the other three parts of the electrical body should strengthen the contractor's hands. Wherever it is possible, on economic lines, to increase his profit, it should be done, and I am distinctly in favor of it. Wherein the contractor has a definite place, i.e., wherein a contractor is the logical one to do the work, I believe that he should be given the work to do, and in this, I am not attempting to use generalities.

For instance, I believe that the contractors of San Francisco should be aided in every way along legitimate lines to handle the vast amount of electrical wiring, etc., and other kinds of installations in the preparations for the Panama-Pacific Exposition. Instead of aiding and fostering the great number of "fly-by-night" contractors who will unquestionably come into this territory, and leave behind them when they go, a stack of debts, which in the economy of things we—most of us—must pay, I believe that we should support our own contractors. It seems that here is a practical application for the Electrical Development League. Possibly that body might express itself in firm tones that our friends at home should be recognized above those concerns who arise over night, and disappear with equal suddenness.

Right here a word of caution:—if your friends in the labor union consider it a time to reap a large harvest in the way of unusual charges for their labor—if the supply men should consider it the time to exact unusual profits, or if the contractor himself decides that he will take the business only on very profitable lines, then surely you can predict that the outsider will see his chance, and will be quick to take advantage of it.

Have you ever considered the possibilities of building up a contracting business based on a reputation for quality of material and workmanship, reliability, etc., as against the business built up purely on the lowest price? The contractor who will establish as his basis of doing business a good reputation, will need to employ salesmen instead of pencil-sharpeners, but in the end, he will have a business to be envied. For this man to succeed, he must bring scientific management into play; he cannot disregard one opportunity for economy. I cannot conceive that the contracting business should differ in respect of rewards for brain effort in such management, from the usual run of business.

Certain of the manufacturers employ engineering corps for the devising of new articles for your use, and for the improvement of the older devices, and the tendency is towards a better article at a cheaper price. The desire of the Fire Underwriters is to encourage the manufacture and use of better class of material; the municipal inspection services are tending that way.

Unconsciously, I believe the average contractor labors in the direction of cheaper and not better material, as being a means to secure the job at a lower price. I doubt if such a position in the long run is wise, or accomplishes this result, for the reason that it tends to depreciate the industry, rather than to uplift it. Has not the time come when your organization should carefully consider this feature, with the idea of building up, rather than tearing down? Your body should make it one of its prime principles. The wise contractor will endeavor to assist the manufacturer with the architect, in securing the adoption of the highest class of material available. The burden of education of the architect and builder should rest equally with the contractor and manufacturer.

Here is another application for the subject of this talk. Boost for the highest grade product. This plea is not solely in the interest of the company which I represent, but in the interest of the entire electrical industry.

Finally, with a full idea of your self-interest, the manufacturer and contractor can best assist each other by good team work; by the elimination of petty jealousies; by a full recognition of the contractor on the part of the manufacturer; in turn, by a breadth of mind on the part of the contractor towards the other portions of the electrical industry; a united effort for reasonable profits; the constant effort in the direction of proper understanding of each other's position in the electrical field; and the eternal forbearance towards the other fellow.

THE EVILS OF THE CONTRACTING BUSINESS AND HOW TO CORRECT THEM FROM THE EYES OF A JOBBER.

BY C. C. HILLIS.

The fundamental principles underlying the conduct of a successful electrical contracting business are no different than they are in any other branch of the industry. In my judgment there are three important requisites in carrying on any business, and they are: Firstly, knowledge of the business; Secondly, sufficient capital; Thirdly, honesty of purpose.

Perhaps in the electrical contracting business the question of capital should come third, as I believe it is possible to do a successful business of moderate size with limited capital, but the other two requirements are absolutely essential.

A person engaging in the electrical contracting business should certainly be equipped with sufficient knowledge of the business to enable him to handle any engineering problems that confront him in estimating jobs, and should have the ability to attend to the proper installation of the material so that in bringing the contract to final completion the work will be done in a first class manner and with the least possible waste.

If he would build for permanency, he should have the highest aims for the conduct of his business, treating his customers fairly as well as keeping in mind constantly that the class of work which he does should be of such order, that it will always stand to his credit in the future.

From the observation of twenty years spent in the electrical business I have seen many evils in the electrical contracting business, some of which are:

An inadequate system of bookkeeping, with an inaccurate record of material used on jobs and job costs;

Insufficient energy in collection of money due, and coupled with this, the fault of too freely granting credit on material sold, or not proper care taken to insure collection of money for work done where dealing with people of hazardous credit;

An inclination to overstock on material, and purchasing material of poor grade because the price is attractive.

Too freely distributing purchases;

Not sufficient effort made to inspire the confidence of your supplier;

Too many engaged in the business for the amount of work to be done;

No stability in prices for doing a particular kind of work.

In regard to the keeping of account books and other records, it is needless for me to say that no business that is growing can be handled successfully without an accurate system of bookkeeping. The number of books necessary to keep accounts straight, of course, will vary according to the size of the business, but the smallest business should have at least a double entry ledger, a cash book, and a day book or journal. With these books they will be able to draw off a trial balance at the end of each month and thus give them some idea of their condition. Some time ago the Electric Appliance Company sent to all of the contracting firms on its trade list a copy of a little book entitled "Bookkeeping for the Electrical Contractor," and I believe we have a few of these left and will be glad to send a copy to any contractor who has not already received one, if they will write in for it. When beginning a job, an account should be opened in the ledger with the particular job, and all the material that is sent out on the job should be charged against it; and any material returned during work on the job, or material re-

turned unused when job is completed, should be credited. All labor and other expenses, in the way of carfare, drayage, etc., should be charged against the job, so that when the job is finally brought to completion the contractor will be in position to tell to a cent what the job cost him to complete, and in this way will be enabled to figure how near he came to the amount of his contract. Every contract taken should stand on its own bottom, and not try to make the profits from one job help to carry the loss on some other job taken at a figure below what it should be.

A fault which is prevalent among a great many contractors is, that they are poor collectors and poor credit men. I do not believe this fault is caused in a great many cases through lack of ability, but it seems to be principally due to the fact that they fear to jeopardize their trade by asking their customers for money. If you would go over the books of any jobbing house you would find that the largest percentage of contract customers are slow pay, principally on this account. The conducting of any business is a serious proposition, and no debtor should be offended when he is asked for settlement on money that is past due. If the contractor does not keep his collections up, in most cases he is not able to pay his supplier, and many times this will cause a lack of confidence to spring up, which frequently could be avoided.

A contractor when doing work should, at all times, see to it that his interests are protected, and where a job calls for work with someone of hazardous credit it should be his business to protect his interests either by guarantee or such other arrangements for settlement as will insure the collection of the account when it is due.

The question of stock is a serious one with the contractor, as it is also with the jobber, and the greatest care should be exercised in the purchase of material. Even though the material purchased might be entirely standard, it is, in my judgment, poor policy for a contractor to buy beyond his requirements of a period of sixty or ninety days at the outside, as to do so would be liable to tie him up on finances, which may be more or less burdensome. I also believe it is poor policy for a contractor to buy material which is not of the highest quality, simply because there is an attractive price attached to it, and then work such material off where it is convenient to do so. The using of any material that is not high grade, simply lowers the standard of the job as a whole and is bound to reflect on the contractor sooner or later, and anyone engaged in the business and expecting to stay in the business and develop it, will find that it pays to have the reputation of doing first class work with no come backs.

I also believe that the contractor should not too freely distribute his purchases. I consider it better policy for him to confine his purchases on all staple lines to three or four suppliers at the most. This is particularly true for the small contractor, who at times will need additional credit beyond what he ordinarily enjoys to carry on some particular job he has in hand, and this plan will also serve to make his business worth while to his supplier who will then have enough interest in the account to see that his customer is kept informed on market changes and give him such other information as will protect him on jobs in hand or prospective.

While on this question of relation between contractor and his supplier, I believe in many instances there is not sufficient effort made by the contractor to inspire the confidence in the mind of the jobber there should be. To get the best results, there should be a mutual confidence between the jobber and the contractor. The jobber on his part should supply first class material at the right price and should give the best of service in the way of prompt shipment, etc. The contractor, on his side, should make it a rule to answer all correspondence promptly and make such effort as is necessary to maintain the full confidence of his supplier. The question of answering correspondence promptly is particularly important where the same refers to the question of accounts. If the contractor finds that he is not in position to meet an account which is due, he will increase the confidence of the supplier many per cent if he will take the initiative in writing a letter of explanation of his inability to pay the account, making at the same time some definite promise if possible which should always be kept. The credit man of any supply organization has a tender spot in his heart for buyers who look after their affairs in this way, and many times you will find the customers he considers most profitable and satisfactory are the ones that look after these details.

There are also too many contractors engaged in the business for the amount of work to be done. How to overcome this difficulty, however, is something I am not able to suggest at this time. There are some of them in the business who have not all of the requirements I previously mentioned, in the way of experience, capital or honesty of purpose. Perhaps some of them have not any one of these requirements, but in such cases they only make a flash in the pan and then are extinguished, but during the time they are in business they serve to make it hard for the legitimate contractor who has the ability and determination to carry on his business successfully.

The contracting business at best is a hazardous one, as there are so many elements entering into its success or failure. Looking at it from an economical standpoint, the contractor's business is the least profitable of any which the electrical supply jobber has on his books. They always enjoy a price which shows a very small margin of profit over the jobbers' cost, and at a profit which is usually way below the jobbers' percentage of operating expense. From the standpoint of credit risk, statistics show that the percentage of loss is at least ten times greater than with any other class of customers which the jobber sells, and I believe that the books of most jobbers will indicate their ratio of loss of accounts on contract customers will average at least two and one-half per cent of their gross sales. This condition is undoubtedly brought about through the fact that many of the losses occur through contractors starting in business without the knowledge or experience necessary to handle the business successfully.

I believe that the contractor is much better off when there is a stability of price on any class of material he purchases from the jobber, and it should be to the contractors' interest to encourage stability of prices rather than by looking for inside prices on material which he buys.

If it was possible to have stability of price among the contractors for doing work of a particular kind, it would be most desirable. This is perhaps a difficult proposition to bring about, but if the cost of material purchased by the contractor was the same as his competitor and his cost of labor doing a particular kind of work was the same, it would seem that there should not be a very wide difference between the figures on any ordinary sized job. The contractor who has the backbone to insist that on all bids he makes he must show a reasonable profit beyond expenses, and will only accept contracts that show a profit, will be in the game long after his competitor who does not keep profits in mind will have passed to the down and out graveyard.

In his working force on a job he should give a great deal of attention to the selection of his men, and while he has to pay the board price for services, his chance of profit on the contract lies largely in the class of workmen he has on the job. It is easy to figure what a good man should reasonably do in a given time, but what he will actually do may vary from his figures many per cent and turn an otherwise profitable job into a loss. There is a better chance for making profit by watching this part of the business closely than there might be on any difference in price in the purchase of material.

There is unquestionably a mutuality of interests between the jobber and the contractor. It is to the jobbers' interests to see the contractor succeed, and he will undoubtedly do what he can to further the interests of the contractor and make his business a success. On the other hand, the contractor should do his part looking toward this end. They should both work for harmony between the two interests.

I would like to say a word in regard to associations of this kind and mention some of the benefits that are to be derived from it.

Thinking men have come to the realization that a great portion of their time is given over to their business, and they also realize they can accomplish much more good for themselves by cultivating the acquaintance of their competitor than they can by fighting him. Business has expanded to such an extent that we are no longer able to keep to ourselves; we often need the help of the other fellow.

It is my belief that the means of education that an association like yours affords, have more to do with the success of your business than you would be willing to grant on first thought.

The most powerful agency in the development of man is his association with his fellow man. It not only develops his mind but has a great influence in the formation of his character. It creates ideas and instills within him the inspiration to put his ideas to the proper use.

When we go to school we acquire a certain amount of education, but the best school of all is the school of experience. There is no theory there; it is actual practice. So it is with an association of men engaged in the same line of business. If we only have a speaking acquaintance with ourselves, we are still working along in the elementary grades. When we come together in association work, we are getting out into the broader channels of trade where we really can and do develop what is in us, where we develop into men who are big enough to see that to be successful ourselves we must lay aside all that is mean and narrow and petty and understand that if this world is big enough for us, it must also be big enough for the other fellow.

Most men of affairs have many talents but they excel in but few. We have our gifted orators who have the faculty of saying fine things at the right time but that orator to get the proper inspiration must have a good listener. So it is in the conduct of business. We must have our good talkers the quiet, unassuming fellow who says little but thinks much, and he is the one who often has to act as the brake and keep the ship of commerce steered in the proper course.
who talk intelligently and tactfully but we must also have

You may look around you or run over in your mind the friends or acquaintances you know, and when you see a man who has made much success, it is done through his close contact with his fellow man.

Some one man may have a good idea but there is usually some other man who has a better one. By combining the two good ideas, however, some plan of operation can be mapped out which is usually the most successful.

It is impossible for a man to associate with a group of men with high aims and a strong sense of right and wrong without absorbing some of the good himself; hence it follows that the man whose methods have been questionable can be educated to become a good worker in the common cause of all when inside the association.

Any association or organization to live and succeed must be founded upon right lines and on principles which do not benefit a few but which will show some returns to its smallest or weakest member. It is logical to expect that in the conduct of an organization that is successful, it must be handled by men who work hard and unselfishly with the idea that what is good for others must also be good for them. They cannot look at things through their own eyes alone but must look at matters in such a way as to meet the approval of their fellow members. A position of this kind cannot be handled successfully by one who is too narrow or who has not the confidence of his associates. Work of this kind not only gives a man a better insight into human nature but his mind unconsciously expands and you soon find that men who formerly were bitter competitors are able to sit down and talk over matters of business which concern them both without the suspicion in their minds that the other fellow is going to betray his confidence.

Perhaps no one thing keeps the average man on the path of righteousness more than the fear of losing the respect of his fellow man. The closer men come in contact with each other the more careful they will be that their acts may be above suspicion. No man will have his faults aired and discussed without trying to correct those faults.

In all bodies of men there are bound to be some backsliders but in time these delinquents will naturally find themselves changing their coat of many colors to one which is more pleasing to the eye.

May we not hope to look forward to the time when all of us will conduct our business, constantly bearing in mind the obligation we owe one another?

DEVELOPMENT OF THE ELECTRICAL BUSINESS BY ADVERTISING.

BY MILTON WISE.

No matter what enthusiastic advertising men may tell you, advertising is not a science and it does not seem to me that it will ever be a science. They speak nowadays of the science of salesmanship and we all know that there are certain laws that govern the art of selling goods. But there are no set of rules that, followed implicitly, will sell a certain kind of goods to all kinds and types of people. Advertising is merely another form of salesmanship and until the laws that govern salesmanship are absolutely fixed there can be no exact science of advertising.

Advertising is accomplishing such wonderful sales results that we are likely to gain an exaggerated idea of its value. If we could peek behind the scenes at some of the great advertising successes, we would see the vast amount of time, care, intelligence and money that has helped the publicity. We would realize that salesmanship, distribution window displays and persistency have been important factors in making these campaigns successful. And we would realize that merely buying space in newspapers and magazines and street cars or on billboards, and filling this space with pleasant words and attractive pictures, do not constitute real advertising.

There can be no doubt as to the value of co-operative advertising in developing the electrical business. We who are in the electrical business on this coast—whether we be contractors or manufacturers or central station men—are confronted with a stupendous opportunity.

Co-operative advertising will help all of us in realizing our possibilities, because co-operative action will bring us together and keep us together. Instead of fighting among ourselves, we will fight, shoulder to shoulder, for one big, all-absorbing purpose.

I do not think that co-operative advertising must always be co-operative in a physical sense. When the electrical interests individually advertise their businesses in an intelligent manner it must impress the public with the value of electrical appliances and of electricity. My definition of co-operative advertising is not necessarily an advertisement that carries as its signature the names of all the concerns engages in the electrical business or the name of an association organized for the promotion of the electrical industry. Wherever the spirit of co-operation is alive and wideawake and wherever this spirit is manifested in two or a dozen individual advertisements, either in the newspapers or the

billboards or the street cars, you have a real co-operative situation.

The problems that confront the co-operative advertising campaign are exactly the same as those that confront the individual advertising campaign. Perhaps it is more difficult to conduct a co-operative advertising campaign because there are so many different kinds of people with different ideas to please that it is difficult to keep the advertising enthusiasm up to the high pitch necessary for advertising success. I don't think that co-operative advertising alone will greatly develop the electrical business unless there is a cordial understanding among all of the various electrical interests. If the contractors or the central stations are doing something that is against the business interests of the industry, from a broad point of view, then all of the co-operative advertising in the world will be a dismal failure.

The best kind of advertising for the electrical business is electrical advertising. Surely the fact that we are willing and anxious to take our own medicine will help convince other people that they should try a little out of the same bottle. A large electric sign advertising a central station or an electrical contractor will do more good than twice the expenditure put into newspapers or street cars or billboards. I am not decrying any advertising mediums. They all have their particular fields. But you will notice that the newspapers and the street cars use first of all their own medium through which to advertise their own business.

Advertising pays in proportion to the care and intelligence exercised in planning and executing the campaign. It takes time and money and a certain degree of intelligence to build advertising that is different and yet not freakish, that carries to the public mind some definite idea. In this day when we are surrounded by so many distractions, when we have so many editions of the daily newspapers and are kept so busy dodging automobiles, it needs a keen mind to plan an advertisement that will reach out, take the casual observer gently by the lapel, turn him face about, and, briefly, concisely and interestingly tell him a merchandising story.

The first influence of co-operative advertising is a moral one. It makes all of us feel as though we were engaged in a great mission. It stiffens our backbones and makes us carry our heads higher.

But before we advertise our virtues let us be sure of them. Let us get together, as we are doing now, to straighten the kinks in our mutual relations, and to create a smooth, sweet running machine.

Then let us plan and execute our co-operative advertising.

THE UNDERWRITERS' RULES.

BY C. W. MITCHELL.

Of the many known causes of fires of which we read daily, there is one in particular in which the members of this Association are interested, and that is electricity. I will admit that many of the fires whose causes are attributed to "crossed wires" are not started by electricity, but yet there are a sufficient number due to that cause to justify municipalities and underwriters maintaining electrical inspection departments.

The hazard of electricity was recognized early in the progress of the electrical industry. On October 19, 1881, the New York Board of Fire Underwriters gave notice that in all buildings in which uncovered electric light wires, or in which arc lights with open bottoms or without globes are found, the wires must be covered, and the lamps altered to conform to the rules of this Board, "and in case the alterations are not made within said time the insurance on said property will be cancelled."

In the early part of 1892, through the initiative of Mr. C. M. Goddard, Secretary of the New England Insurance Exchange, rules were prepared by representatives from various Underwriting Boards in the New England, Middle, South Atlantic and the Gulf States. Out of this grew the Electrical Committee of the Underwriters' National Electrical Association.

In 1897 there was held the first national conference of delegates from various societies and the first edition of the National Electrical Code was issued. The preparation of these rules, however, devolved upon representatives of underwriting organizations. From that time until 1911 the rules were issued in odd years under the direction of the Electrical Committee of the Underwriters' National Electrical Association. The 1911 edition of the Code was prepared by a committee from the National Fire Protection Association. It was decided to turn this work over to the association because it has for its active members National Associations other than underwriting organizations and prepared other standards as regards fire protection and fire prevention.

Of all the rules of the Code the ones which probably concern most the members of this Association are those for "Inside Work." Under this heading are included all of the rules for wiring, for light, heat and power. They do not include the rules for signaling systems, such as telephone, telegraph and fire alarm systems as these circuits are not in themselves hazardous, and become so only through being crossed with light, heat or power wires or on account of lighting discharges.

The present methods of inside wiring are the result of a "cut and try" practice for the past 20 years. Originally wood was considered a sufficiently good insulator and many devices such as cleats and parts of cut-outs, switches, sockets, etc., were made of this material. These wooden fittings and devices have been gradually eliminated, until at the present time nothing but marble, slate, porcelain and certain kinds of composition fittings are permitted. The rules have been gradually extended to take into account the new forms of construction and appliances which have been developed during these years.

In most of the larger structures, such as office buildings, theatres, etc., the electrical installations are planned at the time the general plans of the buildings are drawn. The load in the building, the method of distribution and the running of the wires are completely arranged in order that there may be the greatest efficiency and economy. But this is not always the case with the larger buildings and quite frequently no provision whatever is made in the plans for the electrical equipments in the smaller ones. Many a time have I heard the electrician complain that the architect seemed to think no space was required for the installation of electrical apparatus and yet he didn't want any of the work exposed or would not allow any marring of the "architectural beauty" of the structure. So, between the architect and the inspector the poor electrician has a hard time of it. Oftentimes the electrical work in a building is an afterthought altogether and quite frequently the contract is given to the lowest bidder regardless of the class of work that he does.

However, in spite of all the drawbacks, the general tendency is for an improvement of all electrical installations and a stricter adherence to the requirements of the Code. Although the Code rules may not be perfect, the collection is the best we have, and is the result of years of work of trained and experienced men. Some of the rules have at times been interpreted differently by different men. We are, however, through inspectors' associations and public discussions, making strides toward uniform interpretations. The inspector interprets the rules; he does not make them. And as the honest contractor is guided by the same rules there should be no discord between contractor and inspector. Both should work to the same end, viz.: to establish the National Electrical Code as a uniform standard for all electrical work.

It is thus apparent that the labeled devices, with rare exceptions, are the best of their kind that may be obtained and the contractor who wishes to install only first class work will insist upon having only labeled devices when such devices are included in the label service.

JOURNAL OF ELECTRICITY
POWER AND GAS

PUBLISHED WEEKLY BY THE

Technical Publishing Company

Rialto Building, San Francisco

E. B. STRONG, President and General Manager
A. H. HALLORAN, V. P. and Managing Editor
ROBERT SIBLEY, Treasurer and Editor in Chief
C. L. CORY, Secretary and Special Contributor
A. M. HUNT, Director and Special Contributor

On Library Cars of all Southern Pacific Trains.

TERMS OF SUBSCRIPTION

United States, Cuba and Mexico	per year,	$2.50
Dominion of Canada	"	3.50
Other Foreign Countries within the Postal Union	"	5.00
Single Copies, Current Month	each	.25

NOTICE TO ADVERTISERS.

Changes of advertising copy should reach this office ten days in advance of date of issue. New advertisements will be accepted up to noon of Monday dated Saturday of the same week. Where proof is to be returned for approval, Eastern advertisers should mail copy at least thirty days in advance of date of issue.

Entered as second-class matter at the San Francisco Post Office as "The Electrical Journal," July, 1895.
Entry changed to "The Journal of Electricity," September, 1895.
Entry changed to "The Journal of Electricity, Power and Gas," August 15, 1899.
Entry changed May 1, 1906, to "The Journal of Electricity, Power and Gas," Weekly.

FOUNDED 1887 AS THE
PACIFIC LUMBERMAN, CONTRACTOR AND ELECTRICIAN

CONTENTS

Distribution of Power from Seattle Municipal Plant..... 85

Calculation of Specific Speed..... 90
By Geo. J. Henry, Jr.

Prevention of Electrical Mine Accidents..... 91

Photography in Engineering 92
By M. R. Lott.

Contractors' Convention 93

How the Contractor and Manufacturer Can Assist Each Other in Upbuilding the Electrical Business..... 93
By T. E. Bibbins.

The Evils of the Contracting Business, and Their Corrections 94
By C. C. Hillis.

Development of the Electrical Business by Advertising..... 96
By Milton Wise.

The Underwriter's Rules 97
By C. W. Mitchell.

Editorial 98
A Western Branch of the Bureau of Standards.
A Course of Gas Engineering.
Pronounced Firmness of Western Utility Securities.

Personals 100

Meeting Notices 100

Conservation Committee 101

Trade Notes 101

New Catalogues 101

Industrials 102
New Cutler-Hammer Starting and Regulating Controller.
D. C. Meters.
New Cable Junction Box.

News Notes 104

A Course in Gas Engineering

The Pacific Coast Gas Association last year enthusiastically assembled in convention at Oakland and declared in favor of establishing a chair in Gas Engineering at the University of California. This declaration was not in words alone, for the association is making good its declaration to the extent of $30,000.

The growth in wealth of crude petroleum in California has brought untold riches not alone to the fortunate owners of productive oil wells, but to practically every industry and fireside in the state. The influence of cheap fuel has brightened commercial activity and family life alike. In the industries, hitherto unproductive, high cost of fuel made many classes of manufacturing impossible. In the home life the high cost of cooking and illuminating gas often made life a drudgery. The dirty but happy-faced oil derrick has, however, changed the situation wonderfully. Abundance of oil mixed with a properly sprinkled application of Western brains have brought forth oil gas, which for illuminating and cooking qualities to say nothing of the low cost of domestic supply could hardly have been in the fondest dream of western gas men fifteen years ago.

So rapid has been the advent of oil gas manufacture and so few those prepared to technically enter this productive field, that the present outlook for a successful career in gas engineering, if the young engineer be properly trained, is perhaps more flattering than any of the kindred professions.

The proposal on the part of the Pacific Coast Gas Association to maintain a chair in gas engineering at the State University merits the heartiest commendation. New opportunities, new fields for investigation and finally improved methods in gas manufacture are sure to result.

At the forthcoming convention of the Association in San Diego, the subject of what an ideal course in gas engineering should consist will be brought up for discussion. The outcome will be watched with much interest. Meanwhile the splendid spirit shown by the Pacific Coast Gas Association in thus materially incouraging educational instruction looking toward gas manufacture is receiving the hearty commendation of all.

Pronounced Firmness of Western Utility Securities

Reports from Western public utility companies covering the first five months of 1912 are indeed gratifying. The Southern California Edison Company shows gross earnings of $1,741,441 with net earnings of $843,019 and a surplus fund of $542,300. The Portland Railway, Light & Power Company shows earnings of 5.5 per cent on its $25,000,000 stock. The Pacific Gas & Electric Company, comprising the greatest hydroelectric distribution system in the world, shows gross earnings of $6,277,512; expenses, including taxes and reserves

$3,428,815; net earnings, $2,848,697; bond and other interest, $1,420,643; net income, $1,428,054; bond discount and expense, $41,552; preferred stock dividends, $300,000; common stock dividends, $365,169; surplus for depreciation and other purposes, $721,333.

During the five-months' period covered by the above statement of the Pacific Gas & Electric Company, this enterprising corporation has gained 8300 new consumers. Gas sales, as compared with the same period of 1911, increased more than 245,000,000 cubic ft. and at the present rate will exceed those for 1911 by 600,000,000 cubic feet. The electrical business of the company is also growing at a most satisfactory rate. Contracts for more than 10,000 horsepower were signed up in the six weeks since May 31st, or at a rate of 1600 horsepower a week. This growth was well distributed over the entire system, the average of these contracts being about forty-five horsepower each. Should such a rate of growth continue, it is not unreasonable to see a complete market for all available hydroelectric power supply in the great State of California within the next twenty-five years.

The attitude of Eastern money markets toward Western hydroelectric securities is more encouraging. The common stock of the Pacific Gas & Electric Company, according to the Financial World of New York, was recently lifted out of its rut and was boosted from 61 to 66 in 24 hours. The investors who bought this stock around the high prices of the year have held on tenaciously and this has made the stock scarce.

Again, according to the same authority, a Boston-New York banking syndicate, which a year or more ago underwrote $3,000,000 of the 5 per cent bonds of the Great Western Power Company, is reported to have sold the last of these bonds to the amount of about $1,000,000 to London bankers. At the same time the syndicate is said to have taken up $2,000,000 of the bonds held by New York bankers as security for a note issue and to have been buying up the floating supply of these bonds on the local markets. The result has been that the bonds have moved up from around 87 to 88¾. At the same time both the common and preferred stocks of the Western Power Company, the holding company, have suddenly broken away from the dull state into which they have been for months and speculators have been buying the preferred stock especially in the expectation probably of an early declaration of a dividend. About 1000 shares or more have changed hands daily lately.

All this activity in the securities of this rival of the Pacific Gas & Electric Company means, it is believed, the early consummation of plans for the development of 60,000 additional horsepower from the company's California water power properties not yet in use.

Only a beginning has been made in hydroelectric development in the West, and with conservative public utility commissions to guard the proper issuance of bonds and expenditures from the funds thereby accruing, the enterprises should prove sound business investments to Eastern capital and of incalculable benefit to the future welfare of Western commonwealths.

A Western Branch of the Bureau of Standards

No one department of our national scientific organization seems to have won complete national confidence more quickly than the Bureau of Standards at Washington. Painstaking accuracy characterizes the scholarly papers and determinations sent forth from this bureau. So thoroughly has public confidence been acquired, an instrument checked and approved by the Bureau of Standards is universally accepted as the last work in care to be used in official engineering tests.

Although modern methods of rapid transportation seem almost literally to annihilate distance, yet the length of the journey inevitably jeopardizes the delicate adjustments of highly sensitive instruments. The climbing of the Cascades, the Sierra Nevadas and finally the Rocky Mountains often proves of questionable benefit to instruments on their way to and from the national laboratories at Washington. Long since a deep felt want has existed for a Western branch of the Bureau of Standards. Some weeks back the San Francisco Section of the American Institute of Electrical Engineers unanimously went on record as favoring an early establishment of a Western branch of the Bureau of Standards at the Western Metropolis.

That there should be a Western branch of the Bureau of Standards is not questioned by those who are familiar with engineering needs in this growing section of our country. In deciding upon the permanent location or home for such a branch institution, many considerations necessarily enter. A location as near the center of gravity of Western population as is possible appeals to all without further argument.

The location of a Western branch of the Bureau of Standards in a permanent Western home so that ready access may be had to it by engineers of the world during the great engineering and scientific congresses of 1915 would truly bring about a two-fold result. First it would accomplish the satisfying of a long felt Western want —a branch of the Bureau of Standards suitably located for Western needs—and secondly it would enable the government to effectually exhibit to the world in 1915 the great work now undertaken in this important department of our national scientific life.

But the consideration of actual location is after all a secondary issue. The growth of our great industries in the West has reached such vast proportions that a Western branch of the Bureau of Standards is indispensable. It is to be hoped that other Western scientific and engineering bodies will follow the example of the San Francisco Section of the American Institute of Electrical Engineers and demand the establishment at whatever place is found the best suited for all purposes at the earliest date possible a Western Branch of the U. S. Bureau of Standards.

PERSONALS.

George J. Henry Jr., hydraulic engineer, has returned to San Francisco from Los Angeles.

Will A. Doble, chief engineer of the Pelton Water Wheel Company, has been visiting Los Angeles.

C. F. Conn, of the engineering staff of J. G. White & Co.'s San Francisco office, is at Visalia on business.

F. B. Gleason, manager of the Western Electric Company's San Francisco branch, is on his way to New York City.

Paul Butte, of the Butte Engineering and Electric Company, has returned to San Francisco from the Pacific Northwest.

S. L. Shuffleton, manager of the Pacific Coast interests of the Stone & Webster Engineering Corporation, has gone to Seattle from Fresno.

Arnold Pfau, hydraulic engineer for the Allis-Chalmers Company, arrived on the Pacific Coast from Milwaukee via Los Angeles during the week.

Edson F. Adams, who is interested in several hydroelectric projects, including one on the Owens River, has returned to Oakland after an Eastern trip.

Will C. Caffray, California manager for the Detroit Fuse & Manufacturing Company, has returned to Los Angeles from the electrical contractors' convention at San Jose.

R. B. Williamson, an electrical engineer connected with the power and electrical department of the Allis-Chalmers Company, is at San Francisco on his first tour of the Pacific Coast.

H. L. Jackman, manager of the Humboldt County interests of the Western States Gas and Electric Company, with headquarters at Eureka, is among the recent arrivals at San Francisco.

R. G. Littler, of the West Coast Engineering Company, of Portland, has returned to that city after attending the national meeting of the electrical contractors at Denver and the California meeting at San Jose.

W. F. Durand, professor of mechanical engineering at Stanford University, was in San Francisco during the week and attended the weekly luncheon of the Engineers' Club at the Palace Hotel last Tuesday noon.

Morris Bien, a prominent engineer who has devoted much attention to reclamation work and irrigation engineering, is a recent San Francisco visitor. He is a graduate of the class of 1879 at the University of California.

C. C. Hillis, general manager of the Electric Appliance Company, left for the East during the past week, accompanied by his family. He will go as far as Pittsburg, remaining away about a month for business and recreation.

S. N. Griffith, of Fresno, who has had much to do with electric railway development in the San Joaquin Valley, is at San Francisco. He is quoted as saying that a good deal of such work is in progress or projected in that part of the State.

Sidney Sprout, consulting engineer for the California-Oregon Power Company, is again at the dam site on the lower Klamath River, where work is to be pushed vigorously for the balance of the year on an extensive hydroelectric development.

Boyd Ehle, of the New York office of Sanderson & Porter, has arrived at Victoria, B. C., and will be resident engineer on the new Sooke water supply which is being installed for the municipal government at that point. Wynn Meredith, of Sanderson & Porter's San Francisco office, is consulting engineer for this large project.

W. D'A. Ryan, the General Electric Company's illuminating engineer, is on his way from Schenectady to San Francisco to consult with the engineers of the Panama-Pacific Exposition on the illumination features of the World's Fair in 1915. It is the intention to have as much originality as possible in the lighting of the buildings and grounds.

H. R. Noack, president of Pierson, Roeding & Co., has returned to San Francisco after visiting Los Angeles and putting in the low bid on insulators for the 110,000-volt transmission line for the Los Angeles Aqueduct system. Sixty miles of line will be included in the initial installation, but the system will eventually be extended the entire length of the aqueduct, or about 220 miles.

Harry Hartwell, who has been for some time with Sanderson & Porter of New York as resident engineer on the new municipal water supply at Victoria, B. C., has just accepted a position with the F. S. Pearson Engineering Company of New York. He will shortly pass through California, inspecting the principal hydroelectric developments, while en route to New York City.

Otto E. Osthoff, one of the vice-president's of H. M. Byllesby & Company, of Chicago, has been spending a few days at San Francisco with a party of officials who are on an inspection tour of the plants operated on the Pacific Coast under the name of the Western States Gas & Electric Company. The group includes **M. McCalman**, supervising engineer; **J. W. Link**, hydraulic engineer, and **C. E. Groesbeck**, of Portland, who is the Pacific Coast representative.

Hyal V. Johnson, Jr., a district contractor for the Pacific Telephone & Telegraph Company, was instantly killed last Wednesday by an automobile accident on the Benicia road near Vallejo. He had been connected with the company eight years and resided in Oakland. A. F. Tucker, wire chief at Vallejo and E. E. Lincoln, Santa Rosa, district manager who were in the auto with Johnson when it overturned were seriously injured.

MEETING NOTICES.

The Rejuvenated Sons of Jove will meet at lunch at Tait's Cafe, San Francisco, at 12:30 on August 6. A full attendance is requested as several important matters will come up for discussion.

A number of electrical men of San Francisco are meeting at lunch on Wednesday at 12:30 at the Palace Hotel. The next meeting will be addressed by W. D'A. Ryan, illuminating engineer for the General Electric Company, who will investigate the illumination of the Panama-Pacific Exposition.

TRADE NOTES.

The Allis-Chalmers Company was the successful bidder on eleven pumping engines, 26 in. by 42 in. 36 in. stroke, for the General Pipe Line Company's new pumping stations which are to handle oil from the Esperanza wells.

The Kellogg Switchboard & Supply Company is installing a "phantom" circuit on the 60-mile telephone line of the Madera Sugar Pine Company, extending from Madera to the sawmill at Sugar Pine. The capacity of the line will be doubled at almost a nominal cost.

The General Electric Company has sold to the South Eureka Mine a 400-h.p., 440-volt, variable speed induction motor for use on a mine hoist. It will be mounted on the same shaft with another similar motor. The motors will be controlled by two separate contactor panels and a master-controller.

The Allis-Chalmers Company has been awarded a contract by the Pacific Light and Power Corporation for four big impulse wheels, capable of developing nearly 20,000 h.p. each for the new power stations on the Big Creek development. Each wheel will be direct connected to a generator rated at 11,000 kw. and will be operated under a head of about 2000 feet.

R. B. Elder, representing the Ideal Electric Manufacturing Company, reports the sale of eight 90 h.p. elevator motors for use in the Walker Bank Building at Salt Lake City. The Van Emon Elevator Company has the contract for constructing the elevators for this large office building. The special slow speed motors, operating at 280 r.p.m., will drive the traction elevators.

The Westinghouse Electric & Manufacturing Company reports the receipt of an order from the Pacific Gas & Electric Company, at San Francisco, of one 1000 kw., two-bearing, synchronous motor-generator set consisting of one 1000 kw., 550-700 volts, 514 r.p.m. direct-current generator, and one 1440 h.p. 2300-4000 volts, three-phase, 60-cycle, synchronous motor complete with switching equipment.

The General Electric Company has sold to the Pacific Gas & Electric Company two 1000-kw. motor-generator sets for use at San Francisco. Two switchboards are included in the contract. One of the new units will be installed at Substation C and the other at Substation G. Each unit consists of one 11,000-volt synchronous motor operating at 514 r.p.m., direct connected to one 550-volt d.c. generator

The commercial department of the Pacific Gas and Electric Company has secured a long-term contract with the Union Iron Works, under which all of the electric current needed for light and power purposes at the big ship-building and engineering plant will be supplied at a reasonable rate. This will enable the Union Iron Works to shut down its own electric power plant, which is of larger capacity than is required for the present needs of the shipyard.

Garnett Young, manager of the Telephone-Electric Equipment Company, announces the closing of a contract through the Telephone-Electric Equipment Company's Los Angeles office with the Board of Works of the city of Los Angeles for the bare copper cable for the Los Angeles aqueduct electric transmission system. The cable will cost more than a quarter of a million dollars, and forty cars will be required to transport it from the factory of the American Electrical Works, Phillipsdale, R. I., where it is to be manufactured. A thirty day delivery is promised on the cable which will be supplied in two sizes 350,000 circular mils and 300,000.

CONSERVATION COMMITTEE.

Representatives of the hydroelectric interests in California met July 26 for a conference in the office of John A. Britton of the Pacific Gas & Electric Company for the purpose of selecting a committee to represent these interests at a water power conference to be held either in San Francisco or Washington at the adjournment of the present session of Congress. The session will be called by Secretary Fisher of the Department of the Interior, and there will be representatives from the Geological Survey, the Forest Service, Agriculture Department, the Bureau of Corporations, the California Water Commission and the power companies of California.

Whether the conference is held in San Francisco or Washington will largely depend on the convenience of either city to Secretary Fisher, who has planned a trip to Hawaii. The object of the conference is to discuss the conservation of the hydroelectric resources of California on land owned by the State and the Federal legislation necessary to effect such an end.

At the conference the following committee was selected to represent the water power interests in the State: John A. Britton, chairman, representing the northern section of California; Guy C. Earl, Oakland, representing the central, and H. H. Trowbridge of Los Angeles, representing the southern. Among those who attended the meeting were: H. H. Noble, John B. Miller, A. W. Bullard, Sidney Sprout, Allen Chickering and Charles P. Cutten.

NEW CATALOGUES.

The Crocker-Wheeler Company of Ampere, N. J., has just issued bulletin No. 151, which deals with "Remek" distributing transformers, illustrating their manufacture in an interesting and attractive manner.

The Green Fuel Economizer Company, whose Pacific Coast representatives are Chas. C. Moore & Company, have issued a new 104 page catalogue on Green's Economizers, the first 70 pages of which are largely devoted to a discussion of recent developments in steam plant practice as affecting boiler efficiency and the economical recovery of heat from gases of combustion. A number of original and valuable charts are included.

The Ohio Brass Company have issued their new general catalogue No. 12 which gives a listing of their entire line, including catenary materials, 1500 volt materials, 750 volt overhead material, rail bonds, third rail insulators, O-B Hi-Tension insulators and car equipment specialties. The catalogue is bound in cloth and contains 490 pages which include besides the listing of the different devices considerable data relative to construction schemes.

The Westinghouse Electric Manufacturing Company has issued circular No. 1155, which deals with series arc lighting systems having Westinghouse-Cooper Hewitt rectifiers. Pamphlets on Westinghouse commutating-pole d.c. motors and special underwriters' motors, compound-wound, have also made their appearance in the trade circular No. 1516, is an attractive exposition of the Balwin-Westinghouse electric locomotives. It contains 63 pages of reading matter.

The Department of Publicity of the National Quality Lamp Division of General Electric Company has compiled and is distributing a "Mazda Ad Book," containing suggested models for newspaper advertising copy suitable for use by central stations, electrical dealers and contractors. The advertisements, which set forth the advantages of electric light and of "National Quality" Mazda lamps, are forcefully written and pointedly illustrated. The "Mazda Ad Book" has been strongly approved by the various concerns which have received copies of it, and successful results are being reported from its use.

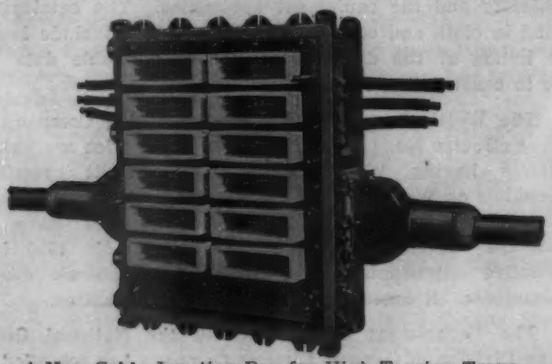
Bulletin No. 1139 of the Fort Wayne Electric Works of General Electric Company on Motor Drives is a handsome picture book showing the many applications of Fort Wayne motors to various machines used in several industries. Bulletin No. 1140 illustrates and describes Type S R Single-Phase Repulsion Induction Motors. Bulletin No. 1136 is devoted to Direct Connected Type M P L Direct Current Generators and No. 1137 to Belt Driven Revolving Field Alternators. Instruction Book No. 3053 is concerned with Multiphase Revolving Field A.C. Generators and Belted Exciters.

The General Electric Company has just issued a number of valuable bulletins. No. 4966 is devoted to a description of Hydroelectric Power Developments, some of them in considerable detail. The bulletin contains numerous illustrations of both station and line construction. Bulletin 4953, entitled "Large Shell Type Transformers," endeavors to place before those interested some of the more important points regarding the relative merits of its different types of transformers. The Electrical Operation of Railroad Shops is the title of Bulletin No. 4959, which is profusely illustrated. Bulletin No. 4960 illustrates and describes direct current lightning arresters for use in connection with electric railways. Bulletin No. 4963 describes a complete line of small motors ranging in size from 1/50 to 1/4 h.p., inclusive, wound for either direct or alternating current. Bulletin No. 4962 is devoted to the use of Electric Power in the Lumber and Woodworking Industries.

INDUSTRIAL

A NEW CABLE JUNCTION BOX FOR HIGH TENSION TRANSMISSION CIRCUITS.

A new type of cable junction box suitable for the interconnection of high voltage feeders and mains is shown in the accompanying illustration. This is believed to be the first high voltage junction box made in this country. It will be noted that the flexible leads which project through the sides of the box are so arranged as to terminate within the large removable nipple. These nipples have a rounded or dome-shaped end made entirely of soft metal such as lead or lead-tin alloy. This dome-shaped portion is united with that portion of the nipple which is of brass or other rigid material by an exceedingly strong and absolutely water tight



A New Cable Junction Box for High Tension Transmission Circuits.

joint. The leads are connected to the outermost contact points of etach row of disconnecting switches, the innermost point being connected to bus-bars, giving the desired interconnecting arrangements.

The exposed live parts—that is, those shown in the cut—are isolated in cells of porcelain so that the disconnecting blades can be inserted or removed by means of insulated tongs with a maximum of safety. The porcelain cells are permanently fastened in a metal framework which, in turn, is fastened to the box, in such a manner that a chamber is formed between the framework of cells and the bottom and sides of the box.

This chamber, after the carrying parts that enter it are put in place and insulated with tape, when desired, and after the moisture has been removed by the heat and vacuum process, is filled with a hot insulating compound. Insulating stuffing boxes prevent the compound from oozing out along the flexible leads when the box again warms up under working load. The concealed current carrying parts of this box are, therefore, assembled and insulated before the box is sent out from the factory, where the work can be done with the greatest care by operators skilled in that particular work under expert supervision.

In order to make the cable connections, all that is necessary, is to unbolt the nipple from the box, cut off, with a saw or jack knife, the dome-shaped end of the soft metal portion of the nipple and, after threading it over the cable, joint the conductors to the insulated flexible lead. After this the nipple can be replaced, the joint wiped and the space within the nipple filled with hot Ozite insulating compound. The connection is then complete.

As the contact blades, when removed, leave the flexible leads dead, it will be readily seen that in this box one or more of the cables may be connected after the box is in service and while it is alive. This box is adapted for interconnecting two or more 1, 2, 3, or 4-conductor cables and may be used for alternating current or direct current circuits.

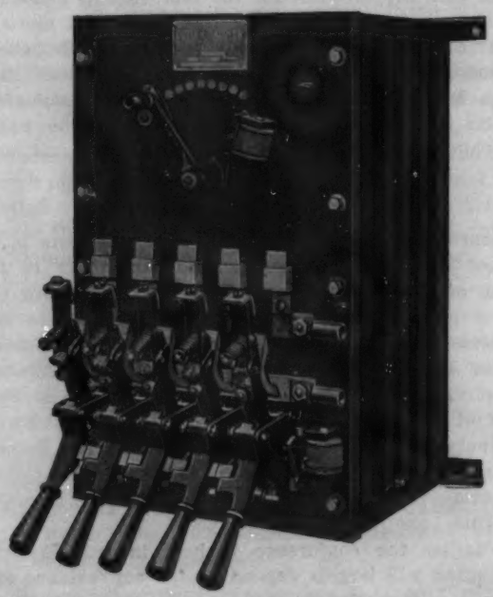
These boxes have been used in considerable quantities on circuits of 4500 volts working pressure for a period of nearly two years with satisfactory results. In other installations they are operating at 5000 volts. The same general design is suitable for still higher voltage.

An interesting reference to the box and its use in one of the largest underground systems in the United States (That of the Pacific Gas & Electric Company), is given in the April Proceedings of the A. I. E. E. in a paper by Messrs. Lisberger and Wilson. These boxes were originally designed to meet the needs of Mr. Lisberger who is chief engineer of the Pacific Gas & Electric Company, and who co-operated with the manufacturer in bringing the design to its fruition.

This box is protected by U. S. Letters Patents and is manufactured by the Standard Underground Cable Company, of Pittsbugh, Pa. It presents some new and interesting features which make for greater flexibility and convenience in this class of equipment.

NEW CUTLER-HAMMER STARTING AND REGULATING CONTROLLER.

A new type of controller for medium and large capacity direct current motors has been placed on the market by The Cutler-Hammer Manufacturing Company of Milwaukee. This controller consists of a multiple switch starter and a shunt field type speed regulator. The starting portion is similar to the standard Cutler-Hammer multiple switch starter designed for use with large motors or with motors of medium size when the starting conditions are severe. Each of the individual levers, when closed, cuts out a step



New Standard Type Cutler-Hammer Starting and Regulating Controller

of armature resistance bringing the motor up to normal speed. The field regulating rheostat mounted above, as shown in the illustration of a 50 h.p., 230 volt type, consists of a series of field resistance steps controlled by a single lever.

When the motor has been properly accelerated to normal speed by cutting out the armature resistance, the field regulating resistance may then be used to secure further increase in speed. If the main line switch is opened or the current supply interrupted, the no-voltage release on the starter opens the starting switches and this, in turn, de-energizes the no-voltage release of the field rheostat, causing the lever to return to the "full field" position.

D.C. SWITCHBOARD METERS.

The D'Arsonval principal consists of the use of a measuring coil without iron, moving in a perfect magnetic field. Direct-current measuring instruments that operate on this principle have inherently the advantage of being entirely free from the effects of residual magnetism, because there is no iron in which the flux is caused to change during the measurement. Further, they make it possible to obtain a uniformly graduated scale by simply providing a uniformly distributed field in the air gap in which the coil moves. These inherent advantages are important, and cannot be obtained with any other type of construction.

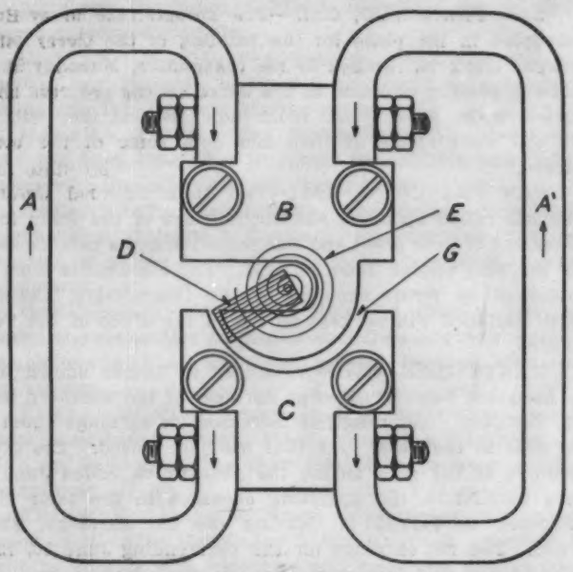


Fig. 1. Diagram Showing Single Air Gap Arrangement of Westinghouse D. C. Meters.

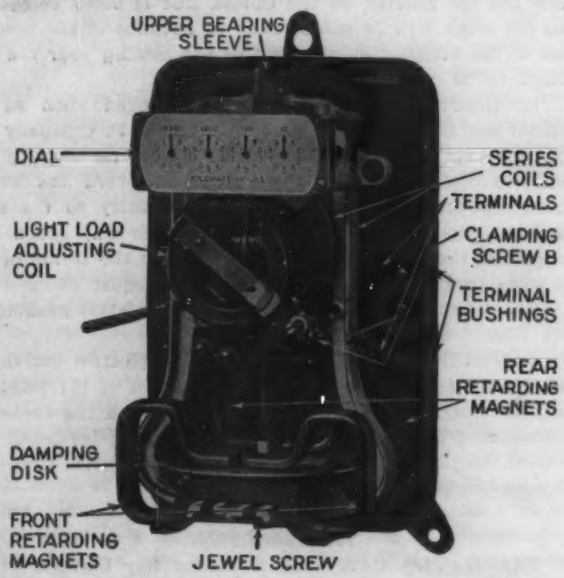


Fig. 2. Moving Element of Westinghouse D. C. Meters.

In the line of 5-inch, 7-inch and 9-inch direct-current meters recently brought out by the Westinghouse Electric & Manufacturing Co., East Pittsburgh, Pa., a unique adaption of this principle is used. The magnetic circuit, consisting of two permanent magnets with pole pieces has only one air gap. The moving coil is pivoted at one side and the opposite side moves in this air gap. This construction, in addition to providing one air gap with large clearance, instead of two air gaps with small clearance, as is generally the case, also makes possible a better balancing of the pointer and results in a number of minor advantages.

The complete magnetic circuit, including the pole pieces, is magnetized and aged as a unit, a process possible only with the single air gap construction because the pole piece does not have to be removed to put the moving element in place. The parts of the magnetic circuit therefore are not changed in assembling the meter after aging so that the strength is not disturbed in any way.

Fig. 3. 7-inch D. C. Voltmeter.

The scales of the meters are calibrated by hand, to give more uniform accuracy than is possible with printed dials.

The meters are furnished as voltmeters and ammeters, in six types: 5-inch, 7-inch and 9-inch round types, also illuminated dial, vertical edgewise, and portable types. The 7-inch round type, because of the length of its scale and flat glass front, marks a distinct advance in meter design. It

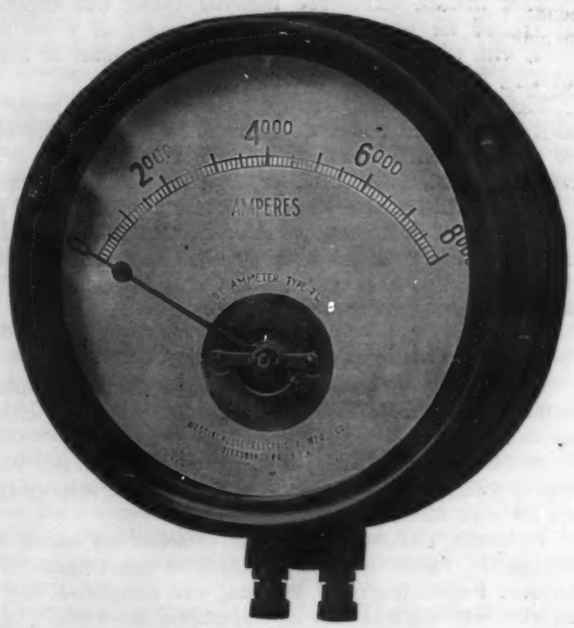


Fig. 4. 7-inch D. C. Ammeter.

will be noted that it can be enclosed in a rectangle of less than 55 square inches, so that it occupies practically as little switchboard space as the smallest "edgewise" meters on the market. At the same time its scale is 7 inches long—as long as the scales on most 9-inch meters, making the indications clearly readable. The flat glass front, exposing the entire pointer to view, adds to the readability and makes it possible to avoid the troublesome reflections encountered in the use of meters with curved scale.

NEWS NOTES

INCORPORATIONS.

SULTAN, WASH.—The Sultan Electric Company has been incorporated at $15,000.

NORTH YAKIMA, WASH.—The Nile Telephone Company, Nile Valley, Yakima county, has been incorporated with a capital of $2400.

GREAT FALLS, MONT.—The Montana Natural Gas Company has filed articles, its object being to install and operate a gas plant here. H. C. Price is interested.

EL PASO, TEX.—The Rio Grande Valley Traction Company which will construct and operate an interurban road down the valley 14 miles distance, has filed articles of incorporation.

VENTURA, CAL.—Moorpark Water, Light & Power Company, $10,000, subscribed $1250, by R. E. Young, E. C. Graham, J. M. Cornett, R. C. Lydston, J. C. Smith, F. M. Cornett and J. M. Stewart.

VALLEJO, CAL.—Vallejo and Napa Valley Gas & Oil Company, $500,000, subscribed $500, by J. O. Hanscom, J. Hancock, and C. Winchell of Vallejo and Walter Rutherford and W. H. Babb of Napa.

ILLUMINATION.

LOS ANGELES, CAL.—The Southern California Gas Company has applied for permission to serve Vernon and Compton, Los Angeles County.

NEW WESTMINSTER, B. C.—The City Council has awarded the contract for the electric lighting plant to the Canadian General Electric Company.

RIVERSIDE, CAL.—The City Council has approved the recommendations of the Board of Public Utilities for the installation of an ornamental lighting system.

SAN DIEGO, CAL.—The Imperial Valley Gas Company has applied for permission to issue $200,000 of 6 per cent bonds, with which to extend its mains to a number of towns, including Calexico and Maxicali.

FAIRFIELD CAL.—An application has been made by the Great Western Power Company for a franchise for electric transmission lines in this city. Sealed bids will be received up to August 27, 1912, for the sale of said franchise.

GLENDALE, CAL.—Manager Harry B. Lynch of this city's lighting department, has started negotiations with Pasadena to serve Glendale with electricity during that time when the city's present contract expires in November and the time when the Owens River power is procurable.

TRANSPORTATION.

SOUTH BEND, WASH.—The Willapa Harbor Telephone Company has decided to build a new line from this city to Bay Center.

FREEWATER, ORE.—The surveyors of the Walla Walla Railway Company are laying out a new electric railway from this place to Hudson Bay.

POMONA, CAL.—Installation of switches and tracks, connecting the Pacific Electric terminus at San Dimas to the Southern Pacific tracks to Pomona, was completed July 23, and work will begin at once on electrifying the road.

SANTA BARBARA, CAL.—The 45-year street railway franchise has finally been awarded to the Cochran-Batchelder Company, who have agreed to reconstruct the local system and double track the main streets; $250,000 will be expended. Reconstruction work on the system will start within 60 days.

GLENDALE, CAL.—R. A. Blackburn, chairman of the railway committee, appointed by the Chamber of Commerce to consult with Paul Shoup of the Pacific Electric Company, reports that the railway company will construct a line on the east side of Glendale, and that about August 1 the company will be ready to present a definite route.

SAN FRANCISCO, CAL.—The normal rate of progress scheduled in the plans for the building of the Geary street railroad has been reached by the contractors, Mahoney Bros., and the present direction of the curve on the progress sheet posted in the Supervisors' room indicates that they will finish the work ahead of time and gain some of the bonus offered.

SAN FRANCISCO, CAL.—The State Railroad Commission has called upon the electric railways of the State for a statement of their profit and loss accounts, and a balance sheet for the year ending June 30, 1912. The statements must be submitted on forms supplied by the Commission, and uniform statistics will be kept on file in the office of the Commission.

MARYSVILLE, CAL.—According to figures shown here by Assistant Secretary George Springer of the Northern Electric Company, that road has increased its earnings about 10 per cent in the fiscal year that has just closed. The gross earnings of the road during the year which ended June 30 were $620,762.34, the operating expenses in the tame time amounted to $412,824.21, leaving the net earnings, $207,938.63. The net earnings for the year ending June 30, 1911, were 10 per cent less.

MARYSVILLE, CAL.—Traffic on the Marysville-Colusa branch of the Northern Electric Railroad has commenced with a construction train making two trips daily between Marysville and Butte Slough. In a week or ten days this service will be extended to Meridian. The bridge work at Meridian will prevent traffic being extended to Colusa for some time, but the grading on the Colusa side is being completed and the track will be made ready in advance of the completion of the bridge. By the first of the coming year the line should be in operation from Marysville.

RICHMOND, CAL.—News that is looked upon as authentic has been received here that the S. P. Company has appropriated $1,085,000 with which to build its electric system into Richmond, using the Cutting-boulevard and Tenth-street franchises, which will give them entry to the most populous parts of Richmond and open the way for a loop around by the Standard oil works. Under the terms of the franchise granted work must begin by August 15, and the statement is made that $50,000 is ready to start grading by that time.

SAN BERNARDINO, CAL.—Pacific Electric surveyors have completed the survey of the extension of the local Arrowhead Hot Springs line to the hotel. When the extension is completed and the San Bernardino-Los Angeles trunk line is built, through cars to the springs will be run from Los Angeles.

TRANSMISSION.

SAN MATEO, CAL.—The Halfmoon Bay Light & Power Company has applied to the Railroad Commissioner for permission to increase its capital stock from $25,000 to $100,000, in order to build 75 miles of extensions with which to serve practically all the towns on the Ocean Shore Railway in San Mateo County.

OLYMPIA, WASH.—A complaint has been filed with the public service commission by the council of the town of Cashmere, in Chelan County, alleging that a power company refuses to remove high tension transmission wires from the main street of the town in spite of the wishes of the council and an agreement entered into previously.

TELEPHONE AND TELEGRAPH.

HOOD RIVER, ORE.—The Home Telephone Company will install the auto-manual system of exchange here.

DEMING, N. M.—The Mountain States Telephone & Telegraph Company has decided to establish district headquarters in Deming.

SANTA ANA, CAL.—The Pacific Telephone & Telegraph Company has purchased a 20-year franchise for an underground system of conduits.

DAYTON, WASH.—The county commissioners have granted Roy McBride permission to construct a telephone line on the Tucanon and Walker range.

KALAMA, WASH.—The Toutle Rural Telephone Company has been granted a franchise to maintain and operate a telephone line along certain county roads.

DAVENPORT, WASH.—The Washington Consolidated Telephone & Telegraph Company contemplates the construction of a line south from here to Harrington, Sprague and Odessa.

OAKESDALE, WASH.—H. Higgs of Rosalia has purchased the Oakesdale telephone exchange and will establish connections with all city and country lines in Oakesdale and vicinity.

CLARA, MONT.—Farmers in the northwestern part of Musselshell county, Mont., have organized a telephone company for building a line from this place to some point on the railroad.

TROPICO, CAL.—The Board of Trustees will receive sealed bids up to September 5 for franchise granting the right to construct a telephone and telegraph system along the streets of this town.

PORTLAND, ORE.—Portland officials of the Pacific Telephone & Telegraph Company are awaiting plans for the skyscraper which is to be erected by the company at the corner of Park and Oak streets. The building will be 12 stories high.

SACRAMENTO, CAL.—The Third District Court of Appeals has granted a writ of mandate asked by the California Telephone & Light Company of Santa Rosa against the Secretary of State to compel him to file its amended articles of incorporation. The Secretary of State's refusal, based on an opinion from the Attorney-General's office, was made because the company had failed to file with its amended articles copies of notarial acknowledgements contained in the original articles.

WATERWORKS.

LOS ANGELES, CAL.—Sealed bids will be received up to August 6 for the installation and rental of fire hydrants from day of approval of contract until June 30, 1913, at any point on mains of the Union Hollywood Water Company within the corporate limits of the city.

PORTERVILLE, CAL.—City Water Superintendent J. E. Curd has reported to the City Council that despite the completion this spring of an auxiliary water plant for the city, steps must be taken at once to again increase the capacity of the plant with a new well and the installation of new machinery. It is reported that plans will be considered immediately for a new well, in the hope of developing a bore which will yield up to 75 inches of water.

TULARE, CAL.—With all necessary data in the hands of the Board of Trustees submitted by Sloan & Robson, engineers, the board will at the next meeting give direction for the calling of an election to vote a bond issue of $100,000 for municipal waterworks. The election, according to the present plans of the board, will be held some time in September.

RIALTO, CAL.—The Fontana Union Water Company plans for development, involving both underground conservation and reservoir storage, and is preparing to issue bonds to the limit of $900,000 to cover the costs. The bonds are to be of the denomination of $1000 each at 6 per cent.

LOS ANGELES, CAL.—Sealed bids will be received up to August 26, for a franchise granting the right to construct a system of water pipes in the public highways of the county of Los Angeles.

TAFT, CAL.—The City Trustees have passed a resolution of intention to install a system of water mains to be used for fire and other purposes in the city and the city attorney has been directed to prepare an ordinance calling for an election on bonds for $12,000 for this purpose.

RICHMOND, CAL.—As the first step toward securing relief against alleged overcharges by the Peoples Water Company and poor service to its consumers in this city the Council has instructed City Clerk I. R. Vankhn to communicate with the Railroad Commission and ask that body to probe the local concern under the provisions of the public utilities act. The Council also named a committee composed of Councilmen J. E. Follett, E. J. Barrard and O. R. Ludewig to cooperate with the committees of the various civic bodies regarding the formation of a water district for the entire city to vote bonds for the building of a municipally owned water system.

ESCONDIDO, CAL.—The Directors of the Escondido Mutual Water Company and Trustees of the city have agreed to have the city purchase the present water distributing system; also to secure on the part of the Escondido Mutual Water Company authorization of an issue of bonds to the amount of $150,000 for developing a greater water supply by increasing the height of the present dam of said company and securing land for additional reservoirs and building necessary dam or dams, the same to be determined after thorough investigation by a competent engineer to be selected by said company.

WOODLAND, CAL.—Out of the 50,000 acres required for perpetual water rights by the Yolo Water & Power Company to justify an expenditure of $2,000,000 for the enlarging and improving of the irrigation system in this county, between 30,000 and 35,000 acres have been pledged, and all the lists for acreage have not been returned yet. The committee that has in charge the solicitation of agreements upon the part of farmers who pledge an acreage to the Yolo County Power & Water Company that will justify the company in the expenditure of $2,000,000 or more for improvements, has reports aggregating between 30,000 and 35,000 acres. Some lists are out that have not been heard from. Only 50,000 acres are required and when that amount is signed up the work will commence.

LOS ANGELES, CAL.—The annual report of William Mulhalland, chief engineer of the aqueduct, read at the meeting of the aqueduct advisory board, showed that, while the aqueduct force is working on a schedule of completion by January 1, 1913, the big ditch and the aqueduct power system are expected to be completed by March 1, 1913.

RIVERSIDE, CAL.—A municipal water system for Riverside seems assured through the approval by the city council of the contract for the purchase of the domestic system of the Riverside Water Company, and the indorsement of this contract by a commission from the directorate of the water company.

PASADENA, CAL.—An ordinance has been framed providing for the issuance of bonds in the amount of $1,250,000 for levying of a tax to pay the principal and the interest upon said bonds to be used for waterworks and a system for supplying water to said city. Said bonds shall be of the denomination of $1000 each, numbered from 1 to 1250, bearing 4½ per cent interest, payable semi-annually, October 1 and April 1.

LOS ANGELES, CAL.—The Funding Company of California has just acquired the People's Water Company of Palms and plans to sink new wells, extend the mains, laterals and improve conditions in general.

ALPHABETICAL INDEX TO ADVERTISERS

Aluminum Company of America
American Bridge Company
Benjamin Electric Manufacturing Company
Blake Signal & Manufacturing Company
Bonestell & Company 12
Bridgeport Brass Company 4
Brill Company, The J. G.
Century Electric Company
Colonial Electric Company
Crocker-Wheeler Company 3
Cutler-Hammer Manufacturing Company
D. & W. Fuse Company 15
Dearborn Drug & Chemical Works 15
Electric Storage Battery Company 15
Fibre Conduit Company, The
Fort Wayne Electric Works
General Electric Company 14
Habirshaw Wire Company
Hemingray Glass Company 12
Hammel Oil Burner Company
Hughes & Company, E. C. 13
Hunt, Mirk & Company
Indiana Rubber & Insulated Wire Company 16
Johns-Manville Company, H. W. 13
Kellogg Switchboard & Supply Company
Klein & Sons, Mathias 16
Leahy Manufacturing Company
Locke Insulator Manufacturing Company 4
Lombard Governor Company
McGlauflin Manufacturing Company
Moore & Company, Engineers, Chas. C. 5
National Metal Molding Company
New York Insulated Wire Company 3
Nuttall Company, R. D.
Ohio Brass Company 13
Okonite Company 16
Pacific States Electric Company 1
Pelton Water Wheel Company 12
Pierson, Roeding & Company 4
Pittsburg Piping & Equipment Company 16
Safety Insulated Wire & Cable Company
Schaw-Batcher Company Pipe Works, The 13
Southern Pacific Company 2
Sprague Electric Works 15
Standard Underground Cable Company 16
Stewart Fuller Company
Tracy Engineering Company
Thomas & Company, R.
Western Electric Company
Westinghouse Machine Company
Westinghouse Electric & Manufacturing Company 6
Weston Electrical Instrument Company 3

TECHNICAL BOOK SHOP

Straight Line
Engineering Diagrams
By Manifold & Poole

Give rapid, graphic solution of field problems in power plant design and construction.

Particularly useful in computing:
Strength of reinforced concrete,
Electric circuits,
Stadia measurements,
Material for steel pipe lines,
Flow of water in pipes,
Pole line construction,
Sizes of steam hoists and engines,
Wood stave pipe lines.

Forty-four diagrams with full explanations and examples. Printed on heavy linen paper.

Price $3.00

Money back if not satisfactory.

The Watthour Meter
By Shepard & Jones

A practical book on electric meters. which should be in the hands of every man who buys, install or inspects metors.

Contains under one cover, in concrete form, answers to every question about all makes of watthour meters.

"Fills a long felt want."

Cloth
184 pages 177 Illustrations

Price $2.00

Money back if not satifactory.

We Carry the Largest Stock of Electrical and Mechanical Books on the Pacific Coast

RIALTO BUILDING SAN FRANCISCO